ARMOUR
INST. OF TECH. LIB.
CHICAGO

Illinois Institute
of Technology
Libraries

Digitized by the Internet Archive
in 2010 with funding from
CARLI: Consortium of Academic and Research Libraries in Illinois

http://www.archive.org/details/armourengineer18inarmo

# The ARMOUR ENGINEER

VOL. XVIII NOVEMBER, 1926 NO. 1

*Published Quarterly by the College of Engineering*
*Armour Institute of Technology*
*Chicago, Ill.*

***Member of Engineering College Magazines Associated***

ILLINOIS INSTITUTE OF TECHNOLOGY
PAUL V. GALVIN LIBRARY
35 WEST 33RD STREET
CHICAGO, IL 60616

# TIMKEN *Tapered Roller* BEARINGS

THE largest producer of electric furnace steel is a bearing maker—Timken. Timken produces electric steel for 132,000 Timken Tapered Roller Bearings daily.

A total of 160,000,000 Timken Tapered Roller Bearings have been applied throughout Transportation, Agriculture, Mining and Industry in general.

Timkens are universally favored because they are more than anti-friction bearings. In addition to being practically frictionless, they also invariably increase endurance, precision, rate of output, load capacity, and *thrust capacity*.

Timken laboratories, Timken engineers, Timken metallurgists—Timken resources—have produced the special features of Timken design which make these bearings a chief element of industrial economics today. Engineering, in every classification, is bound to be more and more concerned with Timken Tapered Roller Bearings.

THE TIMKEN ROLLER BEARING CO.
CANTON, OHIO

*The Timken Engineering Journal consists of 110 pages of engineering material, including bearing tables, recommendations for bearing applications and other authentic, informative material. Copies are available for faculty members requesting them.*

620.5
An 5

The pneumatic Paving Breaker does the work of 15 hand laborers.

# *Evolution of the Ditch-Digger*

Some years ago, when little boys used to yell "Get a horse" at the hesitant and asthmatic vehicle which was the ancestor of the modern automobile, the term *ditch-digger* identified the man who had to perform the hardest labor imaginable. Squads of these workmen would be in the street with their crowbars and hammers, and there was always the sound of metal ringing on metal as the ponderous hammers descended. The passers-by would wonder that no hand was crushed in the process.

That was before the development of the Paving Breaker. Work that fifteen men took a day to perform is now accomplished by one man. Compressed Air has supplanted the uncertain human muscle, and the ditch-digger is no longer the man but the machine.

In this instance, as in a hundred others, Ingersoll-Rand Company has enlisted the aid of Compressed Air in the elimination of wasted time and effort.

**INGERSOLL-RAND COMPANY**
**11 Broadway • • New York City**

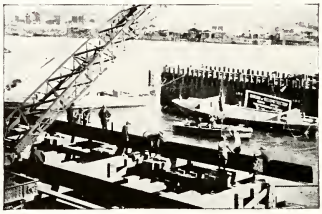
***Offices in principal cities the world over***

# Ingersoll-Rand

*Please mention The Armour Engineer*

46020

# "Sandhogs" Are Working In Japan



Pneumatic caissons and the men who work under air pressure within them—called "Sandhogs"—have been introduced into Japan by The Foundation Company.

As a result of the great earthquakes in 1923, and to avoid future destruction should they recur, unusual forms of construction are being used in Japan.

The Capital, Tokyo, like Venice, has a maze of waterways and many bridges span them. In the building of new bridges over the Sumida River, which divides the city, construction under air pressure was necessary to reach stable foundations.

Importing modern pneumatic equipment from America, the Japanese, under the supervision of Engineers of The Foundation Company, have built the new bridge piers.

The laying of a cutting edge of a caisson; the launching of one; and the installation of pneumatic equipment are shown in the views.

Foundations are but one of many types of structures built by this organization.

## THE FOUNDATION COMPANY

### CITY OF NEW YORK

*Office Buildings · Industrial Plants · Warehouses · Railroads and Terminals · Foundations*
*Underpinning · Filtration and Sewage Plants · Hydro-Electric Developments · Power Houses*
*Highways · River and Harbor Developments · Bridges and Bridge Piers · Mine Shafts and Tunnels*

ATLANTA
PITTSBURGH
CHICAGO

SAN FRANCISCO
LOS ANGELES
MONTREAL, CANADA

MEXICO CITY
LIMA, PERU
CARTAGENA, COLOMBIA

LONDON, ENGLAND
BRUSSELS, BELGIUM
TOKYO, JAPAN

BUILDERS OF SUPERSTRUCTURES AS WELL AS SUBSTRUCTURES

# THE ARMOUR ENGINEER

*Published Quarterly by the College of Engineering*

ARMOUR INSTITUTE OF TECHNOLOGY

Volume XVIII November, 1926 No. 1


## Table of Contents


Cover Design, a Drawing of the Delaware River Bridge by John William Urban, '27. (A description of this bridge appears in the Engineering News section.

A South Side Retrospect ..... 5
J. C. Peebles, '04.

The Northwestern University Stadium ..... 8
James R. Griffith.

The Relation of Chemistry to the Development of the Petroleum Industry. 10
John William Urban, '27.

Summer Camp ..... 13
Walter Pittelkow, '27.

Electrification of the Illinois Central Railroad Suburban Service in Chicago... 14
Wendell P. Monroe.



Published in November, January, March, and May by the College of Engineering, Armour Institute of Technology. Publication office: 3300 Federal Street, Chicago, Illinois. Subscription price, $1.50 per year, postage prepaid. Single copies, fifty cents.



ENGINEERING COLLEGE MAGAZINES ASSOCIATED

*Chairman:* Professor Leslie F. Van Hagan, Madison, Wisconsin.

Armour Engineer
Colorado Engineer
Cornell Civil Engineer
Illinois Technograph
Iowa Engineer
Iowa Transit
Kansas Engineer
Kansas State Engineer
Michigan Technic
Minnesota Techno-Log
Nebraska Blue Print
Ohio State Engineer
Penn State Engineer
Pennsylvania Triangle
Princeton News-Letter
Purdue Engineering Review
Rose Technic
Sibley Journal of Engineering
Tech Engineering News
University of Virginia Journal of Engineering
Wisconsin Engineer

**We urge our readers to take advantage of the technical information that our advertisers will gladly furnish upon request**


COPYRIGHT, 1926, BY THE ARMOUR ENGINEER

# *The Sidewalks of New York*

HAVE become for most of us that very short space between going up and going down. We do not travel much on the surface these days. If our minds were a reflection of our trip through a modern city, we should be at once the most profound and the most ethereal race in the world.

The escalator and elevator carry us from the subway to the surface, from the surface to the elevated subway. The baggage hoist lifts our trunks from level to level. We enter a building and mount to the fiftieth story. Indeed, we have almost abandoned the horizontal, and the force of gravity seems just a bit old fashioned. The Otis Elevator Company has placed at our disposal an entirely new direction.

THE OTIS ELEVATOR must accept a great deal of the responsibility for the crowding of New York's sidewalks in the congested district. This seems fanciful but nevertheless it is true. Newspapers and magazines continually deplore the increasingly over-crowded condition of these sidewalks, due to the ever-increasing height of buildings. If it were not for the developments in the elevator industry made by the Otis Elevator Company as a pioneer, it would not have been possible to erect buildings of the stupendous heights which are now in vogue. It is the high speed Gearless Elevator, now culminating in the 800 ft. speed automatic signal control elevator, which has made the fiftieth floor almost as available in point of time as the twentieth floor, and that has, therefore, made it feasible to pile office on office high into the air.

OTIS ELEVATOR COMPANY

Offices in all Principal Cities of the World

*The*
# ARMOUR ENGINEER

VOLUME XVIII NOVEMBER, 1926 NUMBER 1

## A SOUTH SIDE RETROSPECT

**By J. C. PEEBLES, '04**

NOT only in space, but in time as well, distance lends enchantment. We are eager to pierce the veil of romance and mystery which time has hung about the Valley of the Kings, but how much do we know about the Valley of the Mississippi? Every Chicago schoolboy knows the story of Romulus and Remus and something of the history of the city that "sat upon her seven hills and from her throne of beauty ruled the world." But how much does he know about the city which, swaddled in prosaic and unlovely mud along the banks of a sluggish stream, has become the industrial capitol, powerful and yet beautiful, of a great inland empire?

How much do we of A.I.T. know about our own South Side, of the land whereon we as an institution have lived and worked for a third of a century? Just now we are much occupied with the future, with what it may hold of growing opportunity and expanding achievement. But as we consider the prospect, perhaps we may gain a truer perspective from a brief glance at the retrospect.

Contrary to the understanding of many present-day Chicagoans, Fort Dearborn was not built at the mouth of the river. In 1803, when the fort was established and for nearly thirty years thereafter, the river took a sudden bend to the south about on a line where Michigan Avenue now runs, and entered the lake at the foot of Madison Street. The fort with its stockade and other buildings stood at the bend of the river, until in 1832, the channel was changed to the present outlet. So there is ample historic precedent for river straightening, actual and projected, which has

J. C. Peebles

occupied the attention of the city throughout most of its history.

Opposite the fort on the north bank of the river John Kinzie, first white settler, built his cabin in 1804. Had this hardy pioneer been gifted with prophetic vision he might have stood any day in his humble doorway and with eyes turned far aloft, have seen in fancy the massive flying buttresses of Tribune Tower. The contrast between the simple reality and the splendid vision would have been but typical of little more than a century in the city's growth.

For the first twenty years or more the settlement grew slowly, confined to a few cabins on the north bank of the river, and stores on the south bank, running from the fort to Wolf's Point at the confluence of the north and the south branches. The chief business was the peltry trade carried on with the Indians and a few white hunters and trappers. Prominent among the latter was Gurdon Hubbard, who arrived in 1818, and who was intimately associated with the growth of the city for more than fifty years. Fur trader, meat packer, grain dealer, real estate operator, politician, friend of Lincoln, his career was peculiarly typical of the growing city. Archibald Clybourne was another early settler, arriving in 1823. He built his cabin on the north branch about three miles from the fort, and on his trips to and from the settlement with pork and other farm products for the garrison, he traveled the route where runs the avenue which now bears his name.

In 1833 the settlement was incorporated as a town. Existence was still very much in the rough, filled with hard work, and with few opportunities for the amenities of life. But often on Saturday nights a rough, good-natured crowd would gather in the old Saugannash Hotel on Market and Lake Streets, operated by that genial French Canadian, Mark Beaubien. The indispensable liquid concomitant of gayety was not lacking in the Frenchman's house, and for a time at least the rigors of frontier life were forgotten. Later in the evening mine host would get down his old fiddle and to the shrill notes of a one-piece orchestra all joined in the square dances of the time. A stalwart race were those pioneer men and women. Living as they did under the constant menace of Nature and Nature's savage children, they still maintained their balance, because when the time of relaxation came they played as they

worked and fought, with all their might.

At this time the large area to the west between the two branches of the river was a low-lying marshy plain, covered with coarse grass and cattails, and inhabited by wild ducks and jack-snipes. When the early settler returned home from a day's hunting on the West Side, he placed his well-filled bag in his boat and rowed slowly across the south branch of the river to the east shore. Climbing the low bank he made his way through a fringe of scrubby timber which lined the river and stood for a moment surveying what we now call the South Side. To the northeast the town occupied two streets on the river, South Water and Lake Streets; to the east the land was flat at the West Side, but not so wet, while away to the southeast appeared a low, flat elevation, covered with timber at its northern end. Later a settler built his solitary cabin just at the edge of the timber, a cottage in the grove. In years to come, when a street was laid out along the eastern side of that elevation, an appropriate name was waiting for it.

If our early settler had gone hunting on the proper day of the week he might have noticed, as he looked toward the future, Cottage Grove Avenue, a solitary horseman emerge from the timber and make his way slowly northeast to the town. This was Chicago's first postman bringing the weekly mail from Niles, Michigan. Since streets and buildings serve to conceal the relief of the land, the Chicagoan of today is accustomed to think of the city as uniformly flat. But if he will drive south on Grand Boulevard, he will not fail to note the north end of this low elevation as he approaches Washington Park. And if his imagination is uncommonly good, he may see the postman coming through the park, his saddle-bags filled with letters and papers for the town on the lake.

John Harris Kinzie, when a lad of nine years, witnessed the Fort Dearborn Massacre. The Kinzie mansion (1832). Originals held by Chicago Historical Society.

In 1837, the town was incorporated as a city with William B. Ogden as the first mayor. Even at this early date the nascent city had three golden spokes in its wheel of fortune, three basic industries on which its early prosperity was founded. From Michigan and Wisconsin by way of the lake came great quantities of lumber and soon the main river and the south branch were lined with lumber yards. Farmers drove to town with grain and took back a load of lumber, and soon the frame cottage began to displace the log cabin. Elevators were built along the river to receive the grain, which was shipped to Detroit and Buffalo by water. Pioneers in the grain trade were George W. Dole and Walter L. Newberry, the latter the founder of the Newberry Library. The first steam power elevator in Chicago was built by Wesley Munger and George Armour, the latter a prominent man in the grain business and the board of trade for many years. Thus lumber and grain, together with meat packing, became the sinews of the city's power, three twanging bow-strings destined to project her fame around the world.

In 1848, the Illinois and Michigan Ship Canal was opened to traffic, and proved a great stimulus to business, particularly in the grain and lumber trades. But with the coming of the "iron horse" in the Fifties the city came into its own as the great trade center of what was then the Northwest. The Galena and Chicago Union Railway, now the Galena division of the Northwestern, came in 1850, closely followed by the Michigan Central, Lake Shore and Michigan Southern, Illinois Central, Rock Island, and C. B. & Q. Four of these railroads entered Chicago through the South Side, and did much for the development of suburban property in that direction, particularly in Hyde Park, which was about four miles from the city limits in 1855, when the I. C. began operations.

Dating from the coming of the railroads, Chicago's growth was rapid. In 1860, the population was 100,000, just about equal to the present annual increment. The city threw itself with characteristic vigor into the Civil War, becoming the center of wartime activity for the state which gave Lincoln and Grant to the cause of the Union. On the site of the old Sauganash Hotel, at Market and Lake Streets, stood a large wooden building, known as the "Wigwam." Here was held the Republican National Convention of 1860, which nominated Lincoln for the presidency. Farther east on Lake Street, near Dearborn, stood the Tremont House, perhaps the most famous hotel of wartime Chicago. It was operated by John B. Drake, boniface *par excellence*, whose acquaintance ran the entire gamut of political complexion from Lincoln to Brown to Edward and from John Stephen A. Douglas. VII, then Prince of Wales. The Tremont was one of the fine hotels of the period, but far inferior to the splendid caravansary which now bears the Drake name.

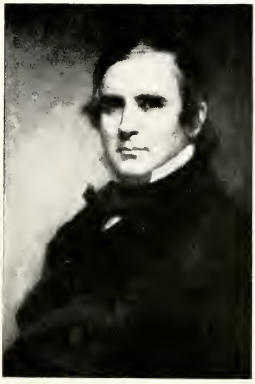
The only authentic reproduction of Fort Dearborn (1803-1812). Drawn from the model in the possession of the Chicago Historical Society by J. M. Gaspard.

In common with the entire country, Chicago saw many dark days in the Sixties, and there was a crying need for the gifted soul who could help dispel the gloom. No adequate story of Chicago for that period can omit mention of the Lumbard Brothers, Jules and Frank, wartime singers. No public gathering was complete without the Lumbards; after listening to the forensics of platform and pulpit, and to the learned obfuscations of lawyer and politician, the crowds always turned gratefully to the singers. On one notable occasion, Frank Lumbard stood in Courthouse Square, where the County Building is located today, and before an immense throng sang for the first time, "The Battle Cry of Freedom." Words and music had been written just the day before by George F. Root, whose bookstore stood on Clark Street near Randolph. The effect was instantaneous, and had greater influence on Chicago's answer to President Lincoln's second call for troops than all the oratory in a score of Wigwam meetings. And so the doubts and discouragements of those trying days were transmuted into the pure gold of courage and high endeavor through the alchemy of song.

Physically, Chicago of the Sixties was very different from the scene contemplated by the duck hunter of thirty years before. The business section had grown south from Lake Street to Madison, and from Market Street, east to Dearborn. South of Madison and east of Dearborn the streets were filled with boarding houses, for the most part hastily built frame shacks, necessary to house the growing population. As yet, there were very few private residences of any distinction in the South Side, with the exception of Terrace Row, located where the Auditorium now stands. This was a solid row of private residences, fronting close to the street and with no open space between adjacent houses, a radical departure from the style of private homes seen on the North Side. There, such a dwelling often stood in solitary grandeur in the center of an entire block surrounded by a high iron fence, as for example, the home of William B. Ogden or Walter L. Newberry.

*Original owned by Chicago Historical Society.*
A view of Chicago before the mouth of the river was changed.

South of Harrison Street, Michigan Avenue soon lost itself in the fields where the cows belonging to the dwellers in Terrace Row were driven to pasture. South of Twelfth Street the grass grew undisturbed and throughout a long summer's day there was little to break the brooding stillness save the clear whistle of the bob-white or the distant tinkle of a cow bell. And often in the late afternoon, at the spot where a milling motor mart now seethes and boils, the cows would stand in the shade of a friendly tree, in philosophical contemplation of time and space.



*Original owned by Chicago Historical Society.*
William Butler Ogden, first mayor of Chicago.

*Original owned by Chicago Historical Society.*
Michigan Avenue from the Lake. Note the trestle built over the water to provide more trackage.

Still farther south a few scattered houses showed the course of Cottage Grove Avenue beyond Twenty-second Street. At Twenty-ninth and the "Grove" was located Myrick Yards, the stock yards of those days. Away to the southwest could be seen the line of Vincennes Road, one of the oldest routes into Chicago. Along this historic highway the farmers used to drive their cattle and hogs to Myrick Yards, until with the coming of the railroads, better transportation was provided. Reminiscent of the early cattle trade in Chicago were Bull's Head Tavern, at Madison Street and Ogden Avenue, where an earlier "yards" was located, and Ten Mile House, at Vincennes Road and Seventy-ninth Street, the last stopping place for the cattlemen and other traders on their way to the city.

In a grove of fine old trees on the west side of Cottage Grove Avenue, between Thirty-second and Thirty-fourth Streets, stood the old University of Chicago. The land upon which it stood, together with much of its resources for buildings and endowment, had been provided by that stalwart Democrat and aristocrat, Stephen A. Douglas. Just west of the university stood a group of military barracks surrounded by a high board fence. This was Camp Douglas, which was used as a Confederate prison camp during the war. At times as many as five thousand "Johnny Rebs" were confined there, many of them coming from Forts Henry and Donelson. Living within the sound of the bugle which regulated the military regime of the fort, and observing the steady tramp of the guards around the high fence, the university students had before them a constant reminder of the grim struggle going on. They were in great demand as soldiers and war leaders, and many served the Union cause with distinction in one capacity or another. Then, as now, seeking the aid of Minerva while doing the bidding of Mars.

Along the south branch of the river

(Continued on page 30)

# THE RELATION OF CHEMISTRY TO THE DEVELOPMENT OF THE PETROLEUM INDUSTRY

By JOHN WILLIAM URBAN, '27

*Student in the Department of Chemistry*

THIS paper proposes to show how chemistry has aided the practical refiner, and further, to outline how and why chemical research will become—as it evidently will—the most important factor in the future progress of the petroleum industry.

The success of most of the large industries in the United States today has largely been due to the efforts of the chemical engineer and the trained research chemist. Very few large industries that have survived to this day use processes that are not scientifically sound. It is apparent that a stable industry can only be based on correct natural principles, which, in turn, are the direct result of research.

Direct chemical contributions to the petroleum industry have been few. Up to about ten years ago, no big industry had been less dependent upon chemistry for its development. A chemist, Professor Silliman, of Yale, furnished the first scientific information about petroleum; it was his recommendation that led to the beginning of the petroleum industry, in 1859.

Herman Frasch, the sulfur expert, was one of the few to really make a notable chemical contribution to the refining of certain oils. By the addition of copper oxide, which Frasch knew to have a strong affinity for sulfur, during the distillation of those Ohio and Indiana oils rich in undesirable sulfur compounds, he was able to satisfactorily remove the sulfur. The value of those high-sulfur crudes was thus increased many-fold by this relatively simple application of chemistry.

But petroleum research, since these early days, has always been several laps behind the rapidly expanding industry. The chief reason for this was that the gasoline could not be marketed, and the liberal supply of lubricating oils, kerosene, and waxes to be found in petroleum made intensive research unnecessary. There was no incentive to improve the yields obtained.

Since the extreme demand for gasoline, and more particularly since the last few years of the World War, the petroleum industry as a whole has become a firm supporter of chemical research. Some of the larger concerns, such as the Standard Oil Company, have given considerable attention to research on petroleum problems for a much longer period, but it is only recently that comprehensive research programs have become a general rather than a rare occurrence.

*Photo by courtesy of the Standard Oil Company of Indiana.*

A battery of pressure stills where cracking occurs. Chemical reactions take place within these stills resulting in the formation of simpler hydrocarbons.

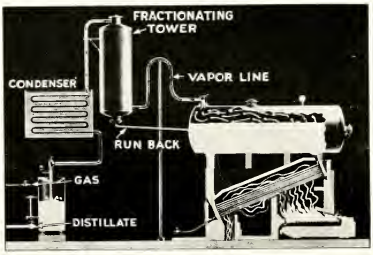



*Photo by courtesy of the Standard Oil Company of Indiana.*

A diagrammatic view of a typical pressure still. In the Burton process, the cracking takes place in the liquid phase.

The petroleum industry of the past has been based on the physical separation of the desired products. With the tremendous growth in the use of the gasoline engine, refining problems became centered on the production of sufficient gasoline to meet the demand. This could be satisfied by increasing the volume of crude run through the refinery, but premature exhaustion of available oil deposits would result, and besides, there was no adequate outlet for the large volume of heavier distillates. It became apparent that some chemical process was needed to obtain higher gasoline yields.

The chemist and the petroleum technologist, closely coöperating, succeeded in utilizing the general tendency of organic compounds to decompose when heated, in a process technically known as "cracking." The industrial application of this tendency, which has been partially solved, is the most outstanding development of the petroleum industry within the last fifteen years. From 1913 to 1924, the amount of crude run through the refineries increased 176 per cent, but the number of automobiles, during the same period, increased 1,100 per cent. Just how well the problem was solved can be seen from the fact that gasoline production kept pace with this expansion.

The process devised by Burton, first patented in 1913, and since subjected to many improvements, ushered in a new era in the cracking of heavy petroleum distillates. It was the logical outcome of a series of experiments which were carried out on an increasingly larger scale, from stills of laboratory dimensions to large pressure stills now used.

The Burton process is one of the most successful in commercial operation. The fact that such a large number of companies controlled by the Standard Oil Co. have installed cracking units, together with the large amount of the total gasoline yield that "cracked" gasoline comprises is evidence of the commercial and practical utility of the process, as well as of its scientific value. In 1913, the yield of gasoline from crude oil was about 12.5 per cent; in 1923 this yield was increased to 31 per cent. In 1922, cracking processes were responsible for over a quarter of the total gasoline production.

The Rittman process, developed during the war by Rittman, Dean, Dutton, and their co-workers of the U. S. Bureau of Mines, present many significant features. The process employs moderate temperatures and high pressures if gasoline is desired, and it has the further advantage of yielding considerable quantities of aromatic hydrocarbons, such as benzene, toluene, and xylene, under different temperature and pressure conditions.

The Bureau of Mines carried out their experimental work at the Columbia University laboratories. Five typical petroleum oils were subjected to a wide range of pressures and temperatures, and the results carefully noted. Favorable and unfavorable conditions alike received detailed attention, for their main purpose was to secure comprehensive data, rather than data on the production of any single hydrocarbon. Such work is of fundamental importance, and the Rittman process, which is a result of it, is an example of what can be expected from a continuation of such extensive chemical research. The Bureau of Mines is leading the attack on the many complex problems which confront the petroleum industry at every turn.

In spite of the commercial success of these processes, little is yet known about the chemical and physical changes involved in the heat treatment of hydrocarbons. Admittedly they are difficult—there are few industrial operations that are more complex in character—and they present a wide range of problems to the trained chemist as well as the practical refiner. Until more of the fundamental principles involved are known and recognized, maximum recovery of desired products from cracking processes can hardly be attained. Research in the next few years will see many fruitful results, not only along these lines, but in every line of attack that the refiners are vitally interested in.

Consumers have always taken a dislike to cracked products. This prejudice was said to be based on the claim that cracked gasoline was inferior to the first-run product. Treatment with sulfuric acid eliminates most of the odor and color, but the gasoline has a tendency to acquire a dark color on standing. One of the chief objections to cracked gasoline is the fact that it causes a heavy deposit of soot in the cylinder of an engine, but, as Hall points out, this is probably due to improper combustion conditions because the nature of the cracked gasoline is unknown. His work seemed to show that cracked gasoline is more efficient in internal combustion engines than ordinary gasoline, due to its slow burning properties. This distributes the power imparted to the piston over the entire stroke, and prevents knocking.

The fact that not all cracked gasolines have antiknock properties suggested a line of research for petroleum chemists. The Pittsburgh laboratory of the Bureau of Mines, together with the research staffs of many of the large companies, is diligently working on this problem. There are two general lines of attack: either some chemical is necessary which, when added to the gasoline reduces the knock, or the antiknock properties must be inherent in the gasoline. Both are typically chemical problems; the latter is the most difficult, as it requires a considerable knowledge of the chemistry of oil refining.

Thomas Midgley, Jr., one of the technologists in charge of the General Motors Corporation research, with his assistant, T. A. Boyd, made the discovery that tetraethyl lead is a satisfactory antiknock compound. The Standard Oil Company of New Jersey also aided in the development of this compound. Should the use of antiknock gasolines become universal, it would be possible to employ high compression engines, which are more efficient than the engines now in use. Due to an unfortunate accident attending its manufacture, tetraethyl lead has been withdrawn from the market pending an investigation by health authorities and prominent chemical engineers.

G. L. Wendt, formerly in charge of research for the Standard Oil Company of Indiana, and Grimm have carried on some very interesting experiments on the mechanism involved in the retarding of the combustion of air-gas mixtures by antiknock compounds. They have proposed an electronic explanation. They explain the propagation of the explosion in a gaseous mixture as due to the presence of free electrons that travel ahead of the flame front and act as detonators. The heavier metals are known to absorb free electrons readily, and these workers suggest that it is the absorption of these free electrons that retards the velocity of the flame front and accounts for its antiknock properties.

Several refining companies within the last few years have been working independently on the problem of obtaining cracked gasoline of superior antiknock qualities. Their technologists are convinced that any effort expended along these lines has not been wasted. It appears from data now available that saturated paraffin hydrocarbons are the least desirable constituents of an antiknock gasoline. Unsaturated olefins, terpenes, and aromatic compounds, such as benzene, having the same boiling range as ordinary gasoline, account for the antiknock properties. In other words, the larger the percentage of hydrogen in a fuel, the better the chances are for knocking. This may possibly be explained, as Cross points out, by the fact that in gaseous mixtures of hydrogen and oxygen, the higher the percentage of hydrogen present the more rapid is the propagation of the explosion through the mixture. One of the functions of an antiknock compound is to slow down this high propagation velocity, so that the energy is not expended practically instantaneously.

The general method of treatment with sulfuric acid removes many of the antiknock substances from gasoline, thus radically different methods for treating cracked motor fuel are necessary before much advance can be made, and chemists already have proposed numerous substitutes. Fuller's earth and similar absorbents have been tried for treatment in the vapor phase, and several refineries are eliminating sulfuric acid treatment in this way. All of these possibilities which cracking processes hold offer interesting as well as important subjects for extended chemical investigations.

John W. Urban

*Mr. Urban's article on the relation of chemistry to the development of the petroleum industry is of such a nature as to provide interest for students of all branches of engineering.*

*Establishment of the fact of its merit was brought about when it was awarded first place in the latest prize essay contest conducted by the American Chemical Society. This contest was open to all students of chemistry. Essays were submitted by students from the leading technical institutions of the country. We feel that Mr. Urban's achievement has brought a distinct honor to the Armour Institute of Technology.*

Probably the biggest reason why more efficient methods of production and refining have not been devised is that the work which only a chemically trained expert could hope to perform has been left for the mechanical engineer or the practical petroleum technologist to do. The organization of an industry minus the services of chemistry is no more complete than an internal combustion engine without its sparkplugs. For chemistry is really an important factor in the petroleum industry, and until it is utilized to this extent, considerable loss and otherwise preventable waste will occur.

It is the complex nature of the products and processes that has retarded to some extent chemical research on the subject of petroleum hydrocarbons. Such work of a pioneer character, when carried out on an extensive scale, will benefit the entire industry. Imagine an industry in which it is estimated that over nine billion dollars is invested, working with a substance about which it knows practically nothing. Bacon expresses this point in the following words:

"One can read in scientific literature pages and pages describing the properties and chemical reactions of hydrocarbons of which at most a few hundred grams may have existed in the whole world, while tons and thousands of tons of hydrocarbons are being produced daily of which we know absolutely nothing regarding their chemical properties, their reactions, and their structure."

Treatises and laborious works on the chemistry of the petroleum hydrocarbons, with few exceptions, list hundreds of compounds which have been isolated from petroleum, and about which are known little else than their physical properties. In some cases not even the physical properties are accurately known. Tables containing these constants vary widely. In one table the figure given for the melting point of normal octane is 98.2° C., while Fororand, as a result of a recent determination, gives it as 57.4° C. No wonder confusion exists.

The composition of petroleum is uncertain. Petroleum probably contains hydrocarbons as high in the paraffin series as $C_{25}H_{52}$, in addition to many cyclic naphthenes, about which little is known. As B. T. Brooks and other advocates of extensive chemical petroleum research have pointed out, the lack of a theoretical knowledge of the non-benzenoid hydrocarbons is the greatest drawback to chemical expansion.

Furthermore, it is doubtful whether most of the individuals described are individuals rather than mixtures. The work of Young and his co-workers, which is considered as some of the most careful work done on the composition of petroleum, has shown how difficult it is to isolate perfectly pure substances from petroleum. Thus, in a mixture of pentane and isopentane, whose boiling points are 8.4° apart, thirteen fractional distillations in a special apparatus were required to separate the two.

These few pages, however, are not intended to convey the idea that chemical research on petroleum has been entirely neglected. They merely point out the many possibilities that have not yet been subjected to rigorous investigation. There have been at work within the past fifty years, engaged in researches of a fundamental character, a small group of remarkably able chemists, and no discussion of the relation of chemistry to petroleum would be complete without mentioning their names. This group includes Warren, Coats, Mabery, Sadtler, Peckham, Storer, and others and their efforts have resulted in a voluminous literature of immense importance in this field. In fact, it may be said, that the chemical knowledge of American petroleum today, relatively small though it may be, is directly due to these earnest and sincere workers.

The need for research is recognized by leaders in the chemical world. Dr. James F. Norris, in a recent address, came directly to the point when he urged the universities to coöperate with the industries in general, and the petroleum industry in particular, on problems of pure research. He urged academic investigators to devote their energies to the solution of the many pressing problems in this field and recommended that "they be approached in the same spirit that led to the triumphs attained in aromatic chemistry."

This will require the concentrated efforts of great numbers of university men over a considerable period of years. The study of petroleum compounds will be much more difficult than the study of coal-tar derivatives, for in the case of the latter the substances can be readily isolated, yielding crystalline derivatives that are easy to purify and handle in small quantities. The university is the place for such work. Walker is more than right when he said that the symbol of the industrial laboratory is the dollar mark, and such laborious study is not directly convertible into money. The value to the entire industry, however, is not measured solely on the ground of the utility of the results. B. T. Brooks, one of the authorities in this field, recognizes this when he says: "A great deal of painstaking, systematic research in the field of the non-benzenoid hydrocarbons must be carried out which may never be utilized directly in an industrial process."

The question of what makes a lubricant is still unanswered. The only test known so far is to try it out on the machine and see. With lubrication such an essential part of industrial activity, the ignorance that prevails on scientific lubrication is astonishing. Mabery has prepared fractionated samples of lubricating oils, one fraction that was satisfactory as a watch lubricant, while the next fraction, when applied, caused the watch to stop. And yet there are no physical or chemical tests known that will distinguish between those samples so far as their qualities are concerned. The selection of a lubricant for a particular purpose is thus "more casual than scientific."

Within recent years there have been plenty of indications that petroleum is a potential source of raw materials for the chemical industries. Formerly, petroleum was associated with gasoline, lubricating oils, kerosene, and paraffin. The service of the chemist has enabled this list to be materially enlarged, so that in the near future it will include dyes, soap, medicines, alcohols, and probably rubber. Due to the stimulation afforded by the recent war, there is a large demand for organic derivatives. If present achievements are any indication, petroleum will soon be furnishing commercial quantities of olefins, cyclic compounds, and saturated paraffins.

Many of the compounds do not exist as such in the oil, but by controlling the distillation conditions the yield of desired products can be partially regulated. This, it may be noted, is one of the ultimate aims of chemical research in this field, for if the conditions controlling the production of various substances are fully known, then refineries will be in a position to supply the market with whatever product is in demand at the time. This will eliminate waste and increase the operating efficiency to a maximum. To be sure, much of the work is still in an elementary stage of development, but with the large amount of research now under way it should not be long before such possibilities are realized. When it is commercially practical to obtain organic substances from petroleum, there will be a ready market for them, since large quantities are used annually in the manufacture of explosives, varnishes, paints, lacquers, solvents, and photographic chemicals.

Synthetic alcohols can now be made from petroleum. One way is to separate the olefins resulting from the destructive distillation of certain fractions by treatment with sulfuric acid and hydrolyzing the sulfuric esters thus formed. These alcohols will find wide use as solvents in the making of artificial silk, films, imitation leather, and waterproof compounds. This process also results in the formation of the complex

*(Continued on page 32)*

# SUMMER CAMP

## By WALTER PITTELKOW, '27

*Student in the Civil Engineering Department*

EVERY summer, students in the Civil Engineering department, who have not already done so, are required to take Course III, commonly known as field practice in surveying. This is one course where work is combined with pleasure, as practically all the work is done in the open among the famous pine trees of Northern Wisconsin. Saturday and Sunday, June 12 and 13, were spent in getting the tents in order. Here students became familiar with such terms as tent fly, halter, bowline, and firemen's knots, and were taught the practical mechanics of tent making by Penn and Griffith Tent Constructing Company, otherwise professors in the Civil Engineering department.

On the following Saturday evenings, the camp Romeos attended dances at Mr. Blazdell's Trout Lake pavilion. Here they soon became known as the dashing engineers to the fair maidens of that section. At one of these dances, Walt Healy, our diminutive pugilist, and a strapping lumberjack did a little talking together.

Of course, every camp tale must also have its fish story, so here is ours. During the first week, Professors Wells, Penn, and Griffith went fishing one night, and returned with twenty pounds of large, shiny Trout Lake beauties, having caught all of them on a *spoon*. Next day there was a run on this kind of fishing tackle and that night Olson and Anderson played the role of fishermen. While they were out, the lake became stormy, making rowing very difficult. Finally, after hard work, they were able to get back to camp at two a. m. with no fish and four hours of lost sleep. We are still looking for the spot where the professors made this catch as we have not been able to find the big ones.

We still believe that the faculty has a soft spot for the students in spite of some of the marks we received. On June 20, we were honored by the visit of Professors Wilcox, Palmer, Libby, and Swineford and Professor and Mrs. Leigh. At twelve o'clock, dinner was served and in the afternoon the annual horseshoe pitching contest was held between the faculty and the students. The faculty was represented by Professors Leigh, Wilcox, Libby, and Palmer, while Schneider, who was the camp champion, Langdon, Freedman, and Stellar represented the students. In spite of the fact that the students were not quite so well versed in the science of horseshoe pitching as the members of the faculty, the students managed to win nine out of ten games.

The 1926 delegation of Civils to the summer camp at Trout Lake, Wisconsin.

Few people realize what fighting a forest fire means. However, Professors Wells, Penn, and Griffith and Mr. Orton have a slight conception of this. On July 5, this party went out on the lake, intending to go over to the opposite shore and there pick up some old government stakes. On the way over they noticed some smoke in the brush and, going there, they found a baby forest fire. After an hour of hard work they managed to put out the fire. In the meantime, Professor Wells went for one of the rangers. Had it not been for the timely arrival of our party, this may have been a serious fire for the brush was well dried out by the intense heat of three days. This fire was probably caused by *Charley's Iron Horse,* which climbs a steep up grade at this section, causing a lot of sparks, some of them probably lodging in the brush.

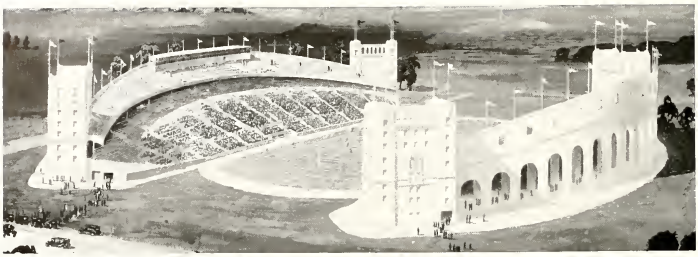
We had a three-day vacation over the Fourth of July. This vacation was spent in various ways. Six canoe parties under Bob Fry and Kernan started up the upper Manitowish and circled around the upper lakes while Olson and Anderson, the two lone wolves, made a trip on the Manitowish and traveled along the lower lakes. Still others went on a hiking tour, two parties going to Lake Superior and another party, Hanson and Swinson, going to Flambeau, where they felt at home among the Indians. Professors Penn and Griffith spent their vacation by going to Minocqua for a hair cut. This town is eighteen miles away. Professor Penn, not being familiar with the traffic rules of this thriving metropolis, population five hundred, made a mistake by making a turn in the middle of the block. He was promptly called by the Chief of Police. However, this experience had some of its kick taken out when the Professor was informed that the Chief had never made an arrest.

Outside of working hours the time was spent in rowing, fishing, swimming, playing horseshoes, and baseball. Some hunting was also done, that is, hunting with a camera. This last sport is quite interesting as it requires skill and patience, to say nothing of courage to stalk a full-grown elk and then forget all about the picture to scramble for some high tree to safety, as Messrs. Anderson, Lodeski, and Orton will inform you.

Chipmunks are as numerous here as exams are at Armour Tech, and quite as annoying at times, too. Tent six had received a box of cookies which were left on the floor near the suitcase one day. Coming in at 4:30 p. m., it was found that most of the goodies were gone. A report of this theft was made immediately to the faculty. Returning after supper the erstwhile Mr. Chipmunk was found at work upon said cakes and the mystery was solved. Now such things are kept in tin cans.

Of course, we had to work as well as play at camp, putting in forty-four hours of work in the field each week. The course was under the direction of Professors Wells, Penn, and Griffith and one assistant, Mr. Anderson. The work consisted of learning the whys and wherefores of tapes, levels, transits,

(*Continued on page 34*)



*Courtesy of the Northwestern University*

Architect's conception of Northwestern University Stadium.

# THE NORTHWESTERN UNIVERSITY STADIUM


## By JAMES R. GRIFFITH

***Assistant Professor of Hydraulic and Sanitary Engineering***


ALTHOUGH the new stadium for Northwestern University does not represent any radical departure from the many types of stadiums already built, yet many Armour students and alumni will be interested in the structure in view of the coming merger with Northwestern University. Some day, we hope to participate in athletic contests on this field.

Ultimate design of the stadium contemplates three decks of seats. However, the Evanston building code would not permit of the building of the third deck at this time. The present two-deck structure is designed to take the additional load of the third deck with necessary connections left for the erection of such, when the demand for space warrants and the building code permits.

The east and west stands are identical in design except for minor details of arrangement. At the present time only a portion of the east stand first deck is to be built. This will have a capacity of about 12,000 seats. The west stand is to have both first and second decks completed, accommodating 20,000 and 5,000 persons, respectively.

Access to the seats is entirely by portals projecting through the deck and attained from the ground by way of ramps and in a few instances by a short rise of steps. Access to the second deck is by way of ramp towers, at each end, and then a long gradual ramp suspended from the second deck. A maximum elevation is attained at the center of the structure.

The major portion of the structure is designed for a live load of 125 pounds per square foot of horizontal projection using 2,000-pound concrete. Both seven and twenty-eight-day test cylinders were taken during each pour. At the last when early strength was demanded, 3,000-pound concrete was used with the addition of fourteen-day test cylinders to ascertain the strength. The strength of the concrete was controlled by water ratio, and practically all test cylinders proved the reliability of the method.

Each stand is divided into five units by expansion joints. Expansion of the second deck steel is taken care of by links corresponding in location to the concrete expansion joints. While all of the first deck and its supporting structure is of reinforced concrete, the second deck is of reinforced concrete supported by steel columns, beams and girders. Topping the west stand is an enclosed press box about 85 feet off the ground.

Planing was very difficult, due to the fact that all columns and connecting beams were laid out on the arc of circles, with the difficulties increasing with height. The football field and structure are laid out symmetrically, about two right angle center lines. Co-ordinates of all columns were figured with respect to these lines from which the footings were located. At each beam and girder intersection with a column, radial lines and grades were required for the form work. As the decks were poured, bench marks were established at convenient points. Many times, however, grades could not be set from the deck and lower grades had to be transferred by tape.

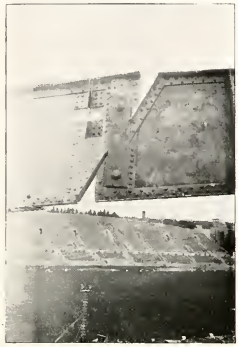
View showing second-deck steel in place. Provision was made for the future addition of a third deck.

The second deck was of the contilever type, therefore, forward columns carried a tremendous portion of the deck load. In addition, these forward columns were spaced at large intervals in order to minimize the obstruction of view. Adequate bearing for forward columns was obtained by either I-beam grillages, or girders when the column came on top of an arch. The rear columns rested on either light grillages or, in many cases, merely a base plate.

Anchor bolts were not used and locating grillages became quite a problem due to the fact that only a few could be located and set at a time as the structure progressed.

The deck proper resembles a series of concrete steps of treads and risers. The seats themselves are made up of three 2-inch by 4-inch red cedar slats, supported by cast iron brackets which are held to the risers by inserts and lag bolts. Minimum lineal seat space was figured at 16¾ inches which in some cases was increased to accommodate the increase in length of arc. On each structure, one row of box seats is provided for the entire length of the structure. Box seats consist of a group of folding backed-chairs enclosed by a pipe railing.

The design of the deck treads and risers is somewhat of a departure from common practice. Instead of the tread and riser simply adding dead weight to the structure, the tread is designed as a narrow slab supported by long narrow risers acting as beams. This called for steel bent to conform to the treads and risers, making pre-bending impractical due to the variation in width of treads and height of risers. As a result, the deck steel was bent in place to conform to the field conditions. Deformed bars were used throughout the structure, with a very elaborate system of chairs and spacers designed to assure the correct location of all steel.



An expansion-joint link. Corresponding joints were made in the concrete.

Most of the forms were built in units at the mill on the premises, and assembled by the carpenters as the structure progressed. In case of questionable intersections, sufficient lengths were provided to permit of cutting to exact length. Power saws and drills were used whenever possible.

Many of the pours involved a lift of from ten to twelve feet. It was impossible to use wooden spreaders and twisted wire ties, for such a height, due to the difficulty of removing the spreaders as the pour progressed. Cement spreaders were made about two inches square and about ten inches long, with a hole lengthwise through the center of the spreader. Steel rod ties were used with buttons on each end held on by set screws. The concrete spreaders, of necessary length, were strung onto the tie rod as it was pushed through the form. When stripping forms, the buttons were removed and the rods withdrawn, leaving only the small hole in the center of the spreader to be plastered up. Drilling holes, for the tie rods, through forms ten feet wide, presented difficulties from the standpoint of alignment. This trouble was largely eliminated by welding an ordinary bit to a rod long enough to permit the drilling of both holes as a continuous operation from one side.

The finished deck. Seating facilities, and method of providing same is illustrated.

The east side had a one-half yard mixer, and the west side a three-quarter yard mixer. Both mixers were provided with mechanical measuring devices for batch material. The concrete was sent by chute direct to the forms, or into central hoppers from which it could be wheeled by buggies. Pouring of large sections was not a daily occurrence, and did not warrant keeping two concrete crews on the job. At least once a week, however, a section of deck would require an overnight pour. At such times the same men carried on the work continuously, their meals being brought to them while they worked. As a consequence, such pours caused the elimination of all but the sturdiest type of labor. Practically only the negroes survived.

The work was carried on under a Landis Award contract, with all trades unionized except the carpenters and laborers.

Office of the athletic department, locker rooms, shower baths, toilet facilities, and all such requirements are housed under the decks. The east stand will ultimately provide living quarters for the caretaker. The east stand has also a practice area for signal drill in bad weather or in secret. Necessary heat for the various rooms is provided by two coal-burning boilers under the west deck, the smoke stack of which is enclosed within the south ramp of that stand.

The major problems in stadium design are capacity, visibility and accessibility.

Capacity is an economic factor wherein the cost of additional seats must be weighed by the possibility of additional gate receipts. Not knowing what the public maximum demand would be, the east side structure was not completed for this season. Yet, from the demand at the season's most popular games, it has been estimated that from $40,000 to $80,000 more could have been taken in had the seats been available.

Visibility depends largely upon elevation, range and direction. The increase in elevation frequently more than compensates for the increase in range. To increase the visibility, all seats are laid out on the arcs of circles, the ideal center of which would be the center of the field, but due to the rectangular playing field must be a flatter arc.

Accessibility involves the ease of attaining all seats, by the public. While the energy expended may be the same, a steep climb will fatigue an individual more than a gradual one. So ramps are used to make the climb as gradual as is practical. The third deck, when added, will necessitate a climb that some people may not be able to make. So, two columns have been designed as elevator shafts for third deck use.

A deck formed with reinforcing in place and ready for pouring.

# ELECTRIFYING THE ILLINOIS CENTRAL RAILROAD SUBURBAN SERVICE IN CHICAGO

*By* WENDELL P. MONROE

*Assistant Engineer, Chicago Terminal Improvement*

FOR 70 years the Illinois Central Railroad has maintained suburban passenger service on its Chicago Terminal. The traffic had grown from 8 trains per week day in the year 1856, to 114 trains per day in 1890, and has reached a volume of 413 trains per week day in 1926. This service has been one of the most important factors in the building of Chicago's south side. At the present time about 26,000,000 passengers are carried annually, or 80,000 per week day, and the rate of growth seems to be increasing.

The high density of traffic and the location of the railroad's right-of-way along the lake front caused electrification to be considered by the railroad and the city as a means of bettering the already superior transportation service and, at the same time, abolishing the smoke nuisance. After several years of discussion the city and the railroad reached an agreement in 1919, by which the railroad is scheduled to electrify its suburban service by February, 1927, its freight service in the downtown district by 1930, the remainder of its freight service in the terminal by 1935, and its through passenger service (under certain conditions) by 1940. In return, the railroad is to obtain certain benefits from the city in the way of property rights and shore line protection.

On July 21, 1926, the first electric suburban revenue train was run, and on August 30, 1926, over 400 regular suburban trains were operated electrically, thus completing the first step in the electrification program five months in advance of the schedule.

The Illinois Central Railroad officials were aware that several types of electrification were in successful operation in this country and abroad, and that a study would have to be made of these systems and the particular requirements of the Illinois Central Terminal so that a system of electrification could be selected which would be the most satisfactory in economy and operation. In 1921, they appointed a commission of three consulting electric railway engineers of the highest repute in this line in the country, and employed them to decide what system of electrification should be adopted. This Electrification Commission and its engineering staff worked for over a year on the problem. In the course of the investigation the systems of electrification considered applicable to the Illinois Central were narrowed to four in number:

1. The 1,500-volt direct current system with overhead trolley.
2. The 11,000-volt alternating current system with overhead trolley.
3. The 750-volt direct current system with third rail.
4. The 3,000-volt direct current system with overhead trolley.

Comprehensive estimates of costs and operating characteristics finally resulted in the recommendation of the 1,500-volt direct current system, the merits of the other systems rating them in the order listed above. The advantages influencing the first choice were lowest first cost, lowest operating cost, simpler cars, economy of 3-phase power generation and transmission as compared to single phase, and absence of the inductive interference trouble and expense which are always present with the alternating current system; all of which made the system selected preferable from the standpoint of total investment and annual charges as well as preferable from the operator's point of view.

The system of electrification having been decided upon, the Electrification Commission was released and a staff of design engineers engaged. Many problems involving extensive investigations were encountered and solved by this staff in the course of the design and construction of the electrification.

The question of power supply was one of the first to be studied. The Commonwealth Edison Company of Chicago wished to be considered as an applicant for the business of furnishing the electrical energy, so a very detailed study was made of the practicability and cost of buying energy as compared to the railroad building its own power plant and generating its own energy. There were certain advantages to the latter scheme from an operating viewpoint, and because the railroad could buy coal from its subsidiary coal mines and transport it at cost. The power company, however, offered the inducements of their large capacity power plants, the reliability of a large interconnected generating and distributing system, and other advantages inherent to a large central station company. The Edison Company's proposal was based on two alternatives, one being the purchase of high-voltage alternating current to be delivered to substations owned and operated by the railroad, and the other being the purchase of 1,500-volt direct current furnished by Edison Company substations and delivered at the right-of-way. After a thorough consideration of the costs and operating problems, it was decided to purchase energy from the Edison Company and accept their second alternative.

*Photo by courtesy of the Illinois Central R. R.*

One of the first electric trains to run on the Illinois Central Railroad after electrification of the suburban service was completed.

The railroad was thus able to obtain the use of seven substations, instead of five as was planned if the railroad owned and operated them, besides taking advantage of a lower cost of energy than would have been possible if the railroad had decided to produce its own power.

One of the seven new sub-stations supplying power to the electrified service. The style of architecture is a novel feature of this station. *Courtesy of the Illinois Central R. R.*

The power contract provides that the actual locations of the substations and the type and characteristics of the equipment are subject to the approval of the railroad company. Also, the operation of the switching equipment controlling the railroad's feeders are subject to the direction of the railroad's power supervisor, and the voltage regulation at the point of delivery will be normally 1,500 volts and always between the limits of 1,550 and 1,400 volts. The voltage characteristics of the converters were to be in accordance with the most approved engineering practice for railroad service.

It is estimated that in the year 1932, the total energy required by the suburban service will be approximately 55,000,000 kw-hr. and the average cost will be 1,367 cents per kw-hr.

The Commonwealth Edison Company and its affiliated company, the Public Service Company of Northern Illinois, the latter operating outside the city limits, designed and built the seven substations under the provisions of the power contract, and the equipment furnished is of the most modern design. The substations aggregate 42,000-kw. capacity and are all controlled manually. Both rotary converters and mercury arc rectifiers are used for converting the alternating current supply to 1,500-volt direct current for the trains.

The rotary converters each consist of two G. E. 1,500-kw., 750-volt, 60-cycle converter units connected in series, and are rated for 150% full load for two hours, and 300% load for one minute. The voltage characteristics and power factor of these 3,000-kw. converters are regulated automatically by a special arrangement called the counter e.m.f. motor system.

The mercury arc rectifiers are of 3,000-kw. and 1,500-kw. capacities. The larger capacity rectifiers, two in number, were manufactured by the Brown Boveri Company, and the smaller ones by the General Electric Company. Each rectifier is at a different substation with the exception of one 1,500-kw. unit which comprises the entire conversion equipment of one of the outlying substations.

The distribution system supplies 1,500-volt direct current to five miles of 6-track district, eight and one-half miles of 4-track district, one mile of 3-track district, nineteen miles of double-track, and four and one-half miles of single-track. Although the traffic density is very heavy during the rush hours, the short substation spacing of about five miles average, and the use of tie stations, make it possible to supply the propulsion energy without feeders other than the catenary wires and the short cables from the substations to the right-of-way.

A complete system of sectionalizing was devised, which makes practically every section of single track between substation and tie station, or between adjacent substations in districts where there are no tie stations, independent of trouble on any other such section. At present, a tie station is located between the two largest substations in the heaviest traffic district, one between two of the outlying substations in the double-track territory, and one on each multiple-track stub end. It is planned to have a tie station between each pair of adjacent substations when the growing load so requires. The sectioning scheme makes it possible to isolate a track length, or section, the switching operations taking place automatically on a short circuit, or by remote control when the section is killed for repairs or for other reasons, the other sections being unaffected. This isolation is accomplished by high-speed circuit breakers, one feeding each end of each section, which open automatically on short circuit and which discriminate so that only the section affected is disconnected. Besides acting as switching stations for sectionalizing, the tie stations serve also to distribute the load more uniformly over all trolleys and thus decrease the distribution losses and voltage drops.

The high-speed circuit breakers used in each feeder from the substations and tie stations are of the G. E. type JR and are extremely fast in rupturing short circuit currents. They distinguish between sudden train loads and short circuits by means of the rate of rise of the current, which is much higher on short circuits than on useful loads suddenly applied. The principle is that of the "bucking bar," which is a one-half turn coil bucking the flux of the holding coil of the breaker. A portion of the entire feeder current passes continually through the low-resistant bucking bar, the remainder going through a copper bar shunt around the bucking bar. This shunt passes through a variable number of soft iron ring laminations. On a sudden

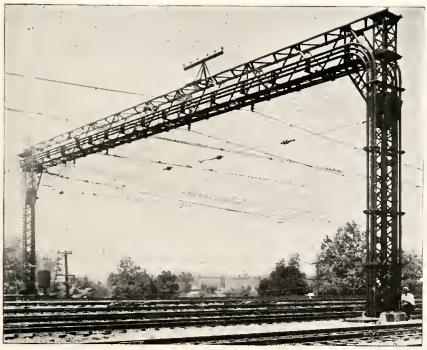


*Photo by courtesy of the Illinois Central R. R.*

A view of the means of support of the over-head wiring system.

rush of current the inductance of the current path through the shunt is such that a much larger portion of the current is forced through the bucking bar, the effect being to buck the flux of the holding coil sufficiently to cause the breaker to open. On a dead short circuit the current is usually ruptured in less than one-hundredth of a second, often being limited to a value below the straight overload of the breaker, thus preventing serious damage from burning at the point of short circuit as well as making the discrimination between circuit breakers easier.

The feeder breakers are mounted on truck type switchboard panels and are easily removed and interchanged. All feeder breakers, whether in the substations or tie stations, are under the control of the railroad power supervisor's office by means of a supervisory control system. The power supervisor has before him at all times indications of the feeder breakers' status and can open and close any breaker from his office.

The catenary system is of the chord, or tangent type. All main line and heavy duty track has a contact system consisting of a main passenger cable supporting, by bronze hangers, an auxiliary messenger cable from which are suspended by clips two contact wires. The main messenger is a composite cable with an outer layer of hard-drawn copper strands and an inner core of copperweld steel strands. The auxiliary messenger is a cable of 19-strand hard-drawn copper. The twin contact wires in the dense traffic district are 3/0 grooved trolley wire of 80% copper-equivalent-conductivity, cadmium bronze. The reason for the bronze is its resistance to wear by the pantographs of the cars. In the districts having less traffic the contact wires are 4/0 hard-drawn copper. The equivalent copper-conductivity of the complete catenary over each track is approximately 800,000 circular mils.

The catenary system is supported by steel structures with normal spacing of 300 feet. They are built-up latticed-angle type steel bridges in districts with three or more tracks, but in the double- and single-track districts they are solid H-section trusses and bracket type structures. The entire design of the catenary and supports was based on one-half inch ice coating on all wires and hangers and with wind pressure of eight pounds per square foot of projected area. The design was carried out with a view toward future electrification of freight and through passenger tracks, and it is planned to build on to the present structures to make them extend over the entire right-of-way when the electrification of these services is started.

The return path of the current is through the rails, each rail joint being bonded with a 4/0 flexible copper bond welded to the head of the rail with an oxy-acetylene flame. Since the right-of-way contains freight and through passenger tracks besides the electrified suburban tracks, these were utilized also for the return circuit where it was desirable to cut down the voltage drop in the rails. Also, cross bonds connecting all tracks together were installed at intervals of about one mile.

Before electrification, the signals were operated by direct current. The use of direct current for traction made it necessary to change the signals to alternating current operation. Impedance bonds in the tracks are necessary to separate the alternating current signal blocks, but at the same time they permit the passage of traction current.

Contemporaneous to the design of the distribution system, and interrelated with it to a large extent, was the design of the suburban electric cars. The specifications as to the number and frequency of trains, schedule speeds, seats supplied, and like requirements had been decided upon by the officials of the railroad with the advice of the Electrification Commission, provision being made for future growth. Studies had been made which resulted in a decision to use an acceleration rate of 1.5 miles per hour per second, a braking rate of 1.75 miles per hour per second, and a balancing speed of 57 miles per hour, as the most economical method of operation which would satisfy the schedule requirements with liberal time margin for making up time and to provide for coasting to save energy.

After a thorough investigation of different schemes of train make-up, including that of operating all motor cars, motor cars and trailers of different combinations, and two-car units of motor car and trailer semi-permanently coupled, the last scheme was adopted. Besides being superior economically, this plan combined the advantage of using four of the well tried and cheaper 750/1,500-volt motors per 2-car unit (as compared to using straight 1,500-volt motors) with the advantage of having only one main controller and two master controllers per unit. The suddenness with which the rush hour demand for cars arrives twice a day minimized the number of extra cars required by the 2-car unit scheme. It was also decided that all 2-car units must be identical and be used in all services, local, express or special.

The study of motor requirements proceeded apace with the design of the cars so that when an accurate estimate of car weight was available the required rating of the motor was readily ascertained. Also, the substation and system load curves could then be accurately determined, and the final details of the feeder copper sizes, substation capacities, etc., settled.

The ratings of the motors were determined from the most severe service. Investigation showed that a South Chicago local train running no-coast to make up time caused the motors to reach a higher temperature than other probable conditions, and was, therefore, the determining service. The average length of run for this service is 0.54 mile, considerably lower than the average run for the system which is 0.83 mile. The average length of run for all local trains is 0.6 mile, for expresses is 0.95 mile, and for specials is 1.7 miles. The length of the South Chicago local trip is 12.5 miles, while the average of all train trips is 14.5 miles, and the maximum is 28 miles.

The special features and main specifications of the electric car equipment follow: The cars are each 72 feet 7½ inches long and seat 84 passengers. Aisles are 3 feet ½ inch wide and, with the vestibules, provide room for approximately 110 standing passengers. The car body is of copper bearing steel, inside sheathing and door of pure aluminum, and roof sheets and lower deck sheets of aluminum alloy. The motor trucks on the motor car are equipped with one motor per axle and 38-inch wheels (new). The weight of the motor car complete is approximately 141,300 lb. and that of the trailer 88,500 lb., both without passenger load. The brakes are electro-pneumatic. The four motors on the motor car are each of 250 h.p. hourly rating and 210 amperes continuous rating, and are of the field-control self-ventilated type. Half of the total motors purchased were Westinghouse 587-D-5 and half General Electric 285-A, their electrical characteristics being such that they are interchangeable. The control is of the General Electric PC type and has the feature of automatic acceleration. The couplers on all cars are of the automatic tight-lock type, and make all electrical and air hose connections in addition to their ordinary functions. A 1,500-volt motor generator set with a storage battery supply 32-volt D.C. current for the control, the lights, and the motors operating the sliding doors. Heat for the cars is supplied from 1,500-volt heating circuits with the units mounted under the car seats, provision having been made to safeguard passengers from the high voltage. A kilowatt-hour meter is mounted under each motor car and measures the propulsion energy of the 2-car unit. Distant dials in the motorman's cabs show the meter reading.

*(Continued on page 34)*

# THE ARMOUR ENGINEER

Published Quarterly by the College of Engineering

ARMOUR INSTITUE OF TECHNOLOGY

Vol. XVIII November, 1926 No. 1



STAFF

Wm. W. Gothard ..... *Editor*
James D. Green ..... *Business Manager*

J. J. Doheny ..... *Articles Editor*
H. J. Kohen ..... *Articles Editor*
T. P. Camp ..... *College Notes Editor*
J. W. Kent ..... *Fraternities Editor*
L. P. Allaire ..... *Societies Editor*
F. D. Payne ..... *Athletics Editor*
C. W. Burcky ..... *Engineering News Editor*
J. W. Urban ..... *Art Editor*
H. B. Ritman ..... *Art Editor*
C. Long ..... *Humor*
L. A. Ohlinger ..... *Publicity*
F. C. Steinhaus ..... *Publicity*
M. T. Goetz ..... *Photography*
L. K. Sairs ..... *Circulation Manager*
W. J. Zenner, C. Vander Molen, G. H. Von Gehr, W. A. Morgan ..... *Editorial Assistants*
P. S. Deiwert, C. L. Lohner ..... *Business Assistants*

Professor C. E. Paul ..... *Advisory Editor*


**Our Slogan:** ***Make The Armour Engineer the best technical college publication in the country***

*"If it were done when 'tis done, then 'twere well it were done quickly!"*
—Shakespeare's *Macbeth.*

## WE HAVE MUCH TO BE THANKFUL FOR

We, students of the Armour Institute of Technology, and beneficiaries of an institution whose present status has been established by all who have preceded us, may well consider that our most worth-while training comes from a direct contact with problems, the solution of which determines the further existence of an activity, or occupation.

The inauguration of each new course, or activity has presented its own set of difficulties which, in the initial course of development, had to be overcome. Financial considerations made soundness of policy an absolute prerequisite. As a result, there have been built up about us a bulwark of policies, or traditions if you wish, grounded on conservatism and efficiency. It requires only observation to establish evidences of this.

We have grown strong in our ambition to perpetuate the name of our Alma Mater. In no way should we look upon our various handicaps as deterrent factors in our progress. Without them, we could not have traveled nearly so far.

The more intimately we acquaint ourselves with the overcoming of these obstacles, and the more general is our information of problems confronting others engaged in analogous enterprises, then the more impressed we become with the worth of our training.

To be specific, in order that you may know better what we wish to convey, representatives of the Armour Engineer attended a convention a short time ago, at a large university. Delegates from twenty-one of the leading college magazines were present. So-called publication and management problems were discussed. Solutions were sought after. Extemporaneous speaking followed. With this, as in all such cases, the actual state of existing conditions was revealed. The general instability of some of the magazines was startling. Managers of papers which represented large and prosperous institutions were confronted with problems which have long since been solved for the Armour Engineer.

Conventions have developed into what may be truly called an American institution. They are a boon to many, and a source of calm and delightful satisfaction to others.

The representatives of the Armour Engineer were able to pause and count over our many causes for thankfulness.

## POLITICS AND THE ENGINEER

By the time that this issue of Armour Engineer is distributed, the November elections will be a thing of the past. Local, state and national servants of the people will have been chosen for the various public offices. Those who have been favored in their desires to serve, find themselves plunged into a new or continued field of activity, with possibly a thought of revised policies to meet the dominant master. Except for the interest-stimulating schemes of enterprising newspapers in the event of creating or unearthing a scandal for the furtherance of their personal policies, political droning will have been reduced to a buzzing of politicians engaged in performing their necessary routine work.

After the violent exertion of voting and contributing to the success of the grab-bag affair, the public relaxes, with its conscience eased by the thought of a duty well performed, into the customary political lethargy of a great republic. Attention is turned to the ever-present needs for living, and the occupation of recreating a politically exhausted being. Pugilistic, gridiron, and like combats are conceded to be most effective in establishing a state of normalcy.

It may appear unusual to the reader, that an editorial of this kind should appear in a strictly technical journal. Let us find justification.

Engineers, by order of their being, have allotted to them certain duties and responsibilities. In a professional way, the safety and well being of the people is placed in their hands. They accept this trust, and in the past have proved worthy of it. Likewise, in the capacity of citizens, the political health of the country has been partially intrusted to their care. The dispatch with which they have executed these latter duties, is questionable. Strange as it may seem, however, both duties are similar and interrelated in that they are discharged in like manners, that both require analytical study, and that the former depends entirely upon the latter for its continued progress and effectiveness.

Engineers are, by training and inclination, a group that study causes and effects, existing conditions and methods of bettering them, and are given to a well balanced and sane visualization of ideal conditions, and how to approach them. Furthermore, they belong to that class of educated, self-thinking, intelligent citizens which comprises about ten per cent of our total population, if such a class exists. Their ability provides an immediately available source of stabilizing forces. Application of these forces would enable self-government in all of its phases to become as well grounded as the engineer's physical structures. Corruption would fade away under the analysis of the motives of corrupt factions.

In order to impart impetus to your political analytical pursuits, let us make one or two suggestions.

On November 2, election day, a referendum was submitted to us to decide the question, "Should the congress of the United States modify the federal act to enforce the Eighteenth Amendment to the Constitution of the United States so that the same shall not prohibit the manufacture, sale, transportation, importation, or exportation of beverages which are not in *fact* intoxicating. . . . ." Determine why those who had charge of the wording of this proposition referred to ". . . . beverages which are not in *fact* intoxicating . . . ." and said nothing about light wines and beer. Then determine, conservatively, just how long it would take to introduce the corner saloon if the flow of ". . . . beverages which are not in *fact* intoxicating . . . ." were legalized.

Also, if the modification of the prohibition amendment is so necessary to our general welfare as one would be led to believe, why is it that other movements, just as beneficial, are not pressed with such zeal and energy. And, when you have discovered, to your own satisfaction, what constitutes this organized effort, determine why it does not declare itself and its true motives, instead of hoodwinking the guileless ninety per cent with such supposedly altruistic motives as are implied by a plea for that intangible condition, *personal liberty.*

# COLLEGE NOTES

## *Cycle Staff Picked*

With the beginning of the new college year, among other things, there have been changes in the faculty. Those who have left Armour Tech. are H. R. Phalen, former associate professor of mathematics and W. Hendricks, assistant professor of English. Professor Hendricks will return next year to take up his work.

The ARMOUR ENGINEER is pleased to introduce its readers to the new faculty members.

---

ARTHUR S. HANSEN, B. S. in E. E. Mr. Hansen was graduated from Armour Institute with the class of 1926, and has entered the mathematics department. Being fresh from the classroom he still has the viewpoint of the student with regard to the instructor, and so should be a very sympathetic, although strict, instructor. He is a member of Phi Kappa Sigma, Tau Beta Pi, Eta Kappa Nu, and Sphinx, and was an active figure in school life.

---

S. J. MCLAREN, JR., B. S. in F. P. E. Mr. McLaren also has gone directly from the classroom into teaching. He graduated from Armour with the class of 1926, and is a member of Delta Tau Delta, Salamander, and Tau Beta Pi fraternities. Mr. McLaren's work will be with the junior and senior classes at the Underwriters' Laboratories.

---

S. R. HADSELL. Mr. Hadsell, instructor in the English department, was graduated from the normal department of Southwest Kansas College in 1899, took his A. B. degree at the University of Oklahoma in 1904, his A. M. degree at Harvard in 1907, and has had two years of post-graduate work at the University if Chicago. He is a member of Phi Beta Kappa and the National Association of University professors.

---

It will of interest to everyone to know that Francis G. Pease, a former student at Armour, and now a noted astronomer, has completed and announced plans for a new telescope. It is to cost twelve million dollars, will have a three hundred inch lens, and will be installed at the Mount Wilson observatory. The present telescope has a lens one hundred inches in diameter.

---

Several things of interest to the prospective engineer have taken place in the boiler room since the last issue of the ARMOUR ENGINEER. The first of these is the completion of the installation of a new boiler, and the second is the new ash handling system that was installed during the summer. Instead of taking the ashes out by hand, as heretofore, they are blown out by steam. This process is much more rapid and economical.

---

The chemical and mechanical laboratories report increases and improvements in apparatus and equipment. This will make for better work, as the classes have been rather large for the amount of apparatus during the last few years.

---

The new course in aviation being offered by the navy department should prove of interest to many. It affords a chance to learn practical as well as theoretical flying, a total of over one hundred hours being spent in the air.

THE progression plan for the election of members of the Cycle Staff went into effect last year. Therefore, on the appointed day, a meeting was held by the 1926 Cycle staff. Presided over by William Gothard, the members of the staff proceeded to chose their successors according to the rules laid down by Sphinx, the honorary literary society. The following men were picked to carry on the work this year:

*Editor*.....M. H. LAMM
*Business Manager*.....W. F. KUFFEL
*Associate Editor*.....M. B. TRACY
*Art Editor*.....J. GROSGUTH
*Fraternity Editor*.....K. H. PARKER
*Athletic Editor*.....R. E. BRUMMUND
*Organization Editor*.....G. KLEINERT
*Humor Editor*.....E. C. BACOT
*Photography Editor*.....W. A. ANDERSON
*Society Editor*.....A. TULLY

With this early start, the staff has been able to organize; plans have been made; and things in general have been gotten well under way. We feel that this advantage of time and co-operation of the student body will enable us to edit one of the best books of the Institute.

---

Dean Monin, who left us early last spring for a visit in Europe, has returned to his desk. At his first class of the year he was given an enthusiastic welcome by the seniors, who are very glad, as are the rest of us, to have him with us again.

---

## CLAUDE ROBERT ALLING, '07

Claude R. Alling, vice-president of Underwriters' Laboratories, died October 25, 1926, after an illness of two weeks.

After graduation from High School, he attended Denver University, Northwestern University, and Armour Institute of Technology, graduating in 1907 from the Institute with the degree of Bachelor of Science in Fire Protection Engineering.

He entered the employ of Underwriters' Laboratories in June, 1907, and served in various positions on the engineering staff with increasing responsibilities until he was appointed assistant to the president in 1925. In February, 1926, he was elected vice-president.

Mr. Alling was an engineer of conspicuous ability, and an executive whose energy and tact made him an outstanding figure in the field of fire protection engineering. His passing has brought to a premature end a most promising career, and leaves with his many friends the affectionate memory of his gay and lovable character.

He was 42 years old last July, and is survived by his widow and an infant son.

For some reason the first assembly of the year was one of the largest and most spirited ever held. Let us hope that the rest may be as large and interesting.

After several selections by the band, which is to be complimented on its excellent performance, President Raymond gave the final figures concerning the maintenance fund, and told us of the work of Mr. DeBeers in organizing and directing the work pledges and collections.

The President then introduced Dean Monin, who was enthusiastically welcomed by everyone. He spoke for a short while, commenting on conditions in this country and abroad.

As a result of the election of two new cheer leaders, James Kent, Senior, and Earle Cooke, Sophomore, the assembly lasted over into the 11:30 hour, much to the delight of the lower classmen.

The election of the senior class officers, ordinarily a long and dreadful struggle, was completed in one period on Tuesday, September 28, setting we believe, a record which will stand unequalled for years to come. The men chosen for office are:

*President*.....J. W. URBAN
*Vice-President*.....K. FIGENBAUM
*Secretary*.....L. P. ALLAIRE
*Treasurer*.....J. D. GREEN
*Social Chairman*.....E. C. YOUNGBERG

The committee chairmen, as appointed by the president, are:

*Cap and Gown*.....R. G. OSGOOD
*Program*.....C. LONG
*Picture*.....W. F. KUFFEL
*Jewelry*.....D. B. DAVIDSON

PROFESSOR WILCOX, head of the physics department and well known radio expert, has been elected chairman of the Chicago section of the American Institute of Radio Engineers. This section is made up of members from Minnesota, Wisconsin, Iowa, Illinois and Indiana.

---

For the benefit of those who use the library, the school has gone to an expense to have the books cleaned and put into good shape.

To those not acquainted with the extent of the library, investigation will reveal a large number of interesting and profitable books, many of which have been added this year. Some of these books are: Chemistry—Inorganic and Organic, C. L. Bloxham; Modern Soap and Detergent Industry, G. C. Martin; Comprehensive Treatise on Inorganic and Theoretical Chemistry, J. W. Mellor; Charles Proteus Steinmetz—A Biography, J. W. Hammond; Thomas A. Edison, F. A. Jones.

(*Continued on page 26*)

---

**Registration First Semester 1926-1927**

| | Seniors | Juniors | Sophomores | Freshmen | Total |
|---|---|---|---|---|---|
| Mechanicals | 24 | 29 | 35 | 42 | 130 |
| Electricals | 40 | 47 | 50 | 63 | 200 |
| Civils | 25 | 33 | 37 | 56 | 151 |
| Chemicals | 14 | 15 | 20 | 26 | 75 |
| Fire Protects | 24 | 33 | 28 | 33 | 118 |
| Architects | 18 | 24 | 26 | 52 | 120 |
| Total | 145 | 181 | 196 | 272 | 794 |
| Special in Electrical Engineering | | | | | 1 |
| | | | | | 795 |

# FRATERNITIES

*The Armour Spirit is Nurtured by Her Fraternities*

## TAU BETA PI

The opening of the school year finds Beta of Illinois with eight men back to uphold her standards. Brother Figenbaum has already returned from the national convention, and reports an excellent gathering and a fine time. The following officers have been selected for this semester:

*President*.....C. W. Burcky
*Vice-President*.....M. T. Goetz
*Recording Secretary*.....N. B. Usler
*Corresponding Secretary*....R. P. Peterson
*Treasurer*.....J. W. Urban

## ETA KAPPA NU

The Delta chapter of Eta Kappa Nu extends its good wishes to the students and faculty as they enter upon their work for the coming year. To the entering Freshmen, we have a few words to account for our existence as a brotherhood. Eta Kappa Nu is an organization of electrical students of the junior and senior class whose character and personality as well as scholastic record have merited them membership into this honorary fraternity.

The officers which have been elected for the coming year are as follows:

*President*.....C. W. Burcky
*Vice-President*.....J. B. Brightman
*Recording Secretary*.....C. W. Schram
*Corresponding Secretary*.....M. T. Goetz
*Treasurer*.....F. J. Ewald
*Associate Editor of The Bridge*.....
.....K. J. Burkhardt

Brother Goetz has been chosen to represent Delta chapter at the national convention to be held this year on November 5 and 6 at Columbus, Missouri.

## PHI LAMBDA UPSILON

Omicron chapter of Phi Lambda Upsilon is going forward this year under the able guidance of Brother Urban, who has just returned full of enthusiasm and ideas from the national convention at Philadelphia. The entire active chapter worked last summer in the chemical laboratories of the Brunswick-Balke-Collender Company at Muskegon, Michigan, getting their first taste of real chemical engineering. Brother Lehman remained in Muskegon, but he expects to return to school in February.

The following are the officers for the year:

*President*.....J. W. Urban
*Vice-President*.....J. J. Janota
*Secretary*.....C. H. Seeley
*Treasurer*.....T. P. Camp

## CHI EPSILON

Chi Epsilon, a national honorary civil engineering fraternity, wishes to announce that the following men are the officers for the present semester:

*President*.....N. B. Usler
*Vice-President*.....B. Z. Cailles
*Corresponding Secretary*.....J. D. Green
*Recording Secretary*.....L. F. Johnson
*Treasurer*.....W. T. Collins

These men were initiated May 25, at the annual spring banquet held in the Brevoort Hotel, after an enjoyable evening. Myron B. Reynolds was taken into the fraternity as an honorary member.

The pledges for the fall semester are as follows:

P. A. Graf
J. C. Harrower
L. A. L. Ohlinger
A. J. Slatalla

## SALAMANDER

Salamander is back again in the ranks ready to start a most successful year. We wish to extend our sincere welcome to all the new students, especially to those following the fire protection engineering course, in whom we are very much interested.

We are very proud to say that we have another alumnus in the Armour faculty. Brother McLaren, '26, is instructing the junior Fire Protects down at Underwriters' Laboratories, and we wish him the best of success with his new undertaking.

The annual election of officers took place last May, and resulted as follows:

*President*.....R. S. Walsh
*Vice-President*.....F. A. Nelson
*Secretary-Treasurer*.....C. E. Herbst

## PI TAU SIGMA

Pi Tau Sigma extends to everyone in general, and Mechanicals in particular, our heartiest wishes for the coming year.

Delta chapter has opened upon its third, and what is going to be its most successful, year with the following men as officers:

*President*.....K. Figenbaum
*Vice-President*.....W. Schroeder
*Treasurer*.....W. F. Weber
*Secretary*.....R. P. Peterson
*Corresponding Secretary*..R. A. Harschnek

## PHI KAPPA SIGMA

With the beginning of a school year in September comes also the founding and starting of a new Freshman class. They are first welcomed as a class by the President and the Dean, and the school in the opening assembly. Then they are welcomed as individuals by the faculty and school at the Freshman Handshake. But the first time the fraternities as a group have a chance to give a word of welcome to the Freshmen, as a class, is through this November issue of the Armour Engineer. At this time, Alpha Epsilon chapter of Phi Kappa Sigma extends her heartiest welcome and greetings to the new well-established class of '30.

Of course, in the fraternity house the prerequisite for the opening of school is house cleaning. This started at Alpha Epsilon the week preceding the opening of school. The house was entirely redecorated and the floors refinished from the attic to the basement. For a while, it seemed there would be no end to the work, but at last came the time when we could sit back and admire our work, and see that it was not in vain.

At the start of each school year a fraternity always notices the great gap left by the graduation of its Seniors of the year before. At first we wonder how we will get along without them, but it always seems as though the underclassmen most ably fill the vacancies that have been left. Alpha Epsilon lost eight men by graduation last year. With the exception of two men, the rest of the chapter is back to school this year, full of enthusiasm and anxious to make this a banner year for our fraternity.

At the writing of this article it is almost too early to speak of the activities of Alpha Epsilon. The attendance at the Freshman Handshake was 100 per cent. Shortly following this, came the rushing period. Alpha Epsilon's program contained smokers, dinners, theater parties, and dances. Soon after this came the celebration of the birthday of Phi Kappa Sigma.

Her birthday party consisted of a banquet sponsored and attended by the Alpha Epsilon chapter of Armour, the Alpha Pi chapter at University of Chicago, the Upsilon chapter of Northwestern University and the Phi Kappa Sigma Alumni club of Chicago. This celebration of the seventy-sixth birthday of Phi Kappa Sigma was a most successful one. It marked the passage of another milestone in the history of our fraternity, and with the seventy-sixth year already under way the fraternity as a whole plans to make it bigger and better than ever before.

## THETA XI

The semester was begun with four days of very intensive house-cleaning. The house was figuratively turned inside out and shaken to remove the dust of summer days. Of course, we suffered from the usual number of anecdotes relating to summer pastimes, but we have learned to bear those with fortitude. All of the chapter were back with the exception of last year's seniors. Brothers Kreilbick and Vandaveer returned after an absence of a year and six months, respectively. The chief trophies of the summer were a number of broken-down Flivvers, owned by various Brothers and destined to grace the front of the House for many a day. Of all that motley throng, "*Pneumonia*," the T. X. Ford, still reigns supreme with the nearest competitor far removed in the background.

Plans were started at once for the coming social season and the first House Dance was held early in October. Needless to say, the House was crowded and an exception band helped make the hours pass all too swiftly. Of course, our biggest dance is on Halloween and this year, the plans are even more elaborate than before. The House, when transformed, will make even the most sophisticated gasp and is destined to leave the unprepared in convulsions. Theta Xi is preparing for a constructive year, both in the chapter and at Armour, and we hope that this year will be one of the finest in the history of the Institute.

## SIGMA KAPPA DELTA

The school year has again opened with its renewal of friendships severed during the summer. Vacation tales and experiences have been expounded, compared, and exaggerated until quite threadbare. To the incoming Freshmen, we share the spirit of the school in welcoming you among our midst and wish you success in all your endeavors — may they be numerous and varied.

(*Continued on page 26*)

# SOCIETIES

## *New Organization Established*

### ARMOUR TECH FELLOWSHIP CLUB

The Armour branch of the Y. M. C. A. has passed into history. In its place has been established a new student organization known as the Armour Tech Fellowship club. This new club has grown from the Y. M. C. A. as a nucleus, and has started its membership with the old Y. M. C. A. enrollment.

The Armour Tech Fellowship club has been designed to fill the requirements of a very much needed organization on the Armour campus. It is to function as a campus meeting place where students may spend open hours in study or in fellowly union, with intent to further mutual acquaintanceship and good fellowship. The club is open to any student enrolled at Armour Institute. It is an independent, self-governing organization, established under a constitution framed jointly by the members and by the Executive Council of Armour Institute. It will take over the work of the Y. M. C. A. as part of its annual program, and it has every intention of spreading its spirit of good fellowship campus wide.

The officers and members take this opportunity of inviting all those who do not already belong, to visit the club rooms and become acquainted with the members. The officers, Messrs. Enke, Efner, Burcky and Vevurka, will be glad to explain the details concerning membership, to any one who is interested.

### ARMOUR TECH MUSICAL CLUB

A few years ago, a group of men interested in the development of the various musical organizations at Armour, decided that the three clubs should be merged into one, for mutual benefit, under the title of the Armour Tech Musical Club. The consolidation proved extremely effective since their work and purposes were unified under the direction of one group of officers. Under this plan they have given many successful concerts and represented the Institute, both singly and together, at a number of important meetings and gatherings. The organization is a member of the Armour Tech Athletic Association, and the fees for its maintenance must necessarily come from that source. Being primarily a student body, the club is managed by its own officers but assisted by a faculty adviser who is completely in accord with both students and the Office of the Dean. This, in brief, is the history and organization of the club.

If we can create a larger organization, a greater amount of general enthusiasm and a wider national reputation for Armour, we will have completed the work of this year in a satisfactory manner.

A meeting was held on Monday, October 11, at which the following men were elected:

*President*.....K. H. Parker
*Vice-President*.....G. A. Petters
*Secretary*.....W. T. Wilson
*Treasurer*.....D. G. Greenfield
*Business Manager*.....M. Horn

### ORCHESTRA

Men—we need men—any man who can play an instrument. For five years this cry has appeared in each publication of the Armour Engineer; at each opening assembly, and the bulletin board at the beginning of each week.

It must be admitted that our orchestra, as it stands, is a far cry from the sweeping violins, and the crashing brass, of a symphony orchestra of large proportions. Yet both bear the same name.

If, in our student body of nearly one thousand, all the fellows who could play or who have played, would come out and give us their hearty support—our organization would some day become a real symphony orchestra, capable of anything from fox-trots to symphonic tone-poems.

There is no reason why it should not be so at Armour.

There is a gym credit offered for each semester of work in any one of the musical clubs.

Once more fellows, the old time-worn song "Let's see some new faces on Tuesday," and help make that "bigger and better orchestra" materialize.

### BAND

A baton taps a stand lightly, a long roll-off sounds from the drums, and then from the instruments and the mouths of seven-hundred fifty students come the stirring notes of the Armour Fight Song. You have the tingle—we all have it—that little trembling sensation at the base of your spine that gradually spreads all over until your whole body is suffused in an exhilarating glow. School spirit. That's what it is, an all-pervading influence that can fairly ooze out of one when he sings of his school to the accompaniment of a band and some seven-hundred singing fellow students. But it all comes from that group of earnest players with the leader throwing himself into the work of producing music, and fairly dancing over the stage. Watch them draw the entire audience into the spirit of the occasion and you will understand what a band can mean to a school.

But will you support that band? *We want men* whom we can count on and who are interested, heart and soul, in Armour. Think what a band of 75 men, equipped with uniforms, would do to foster school activities. If you are the type of men we are looking for, see Mr. Rezac, the leader, next Monday night, and he will acquaint you with the various advantages of being in the organization.

### GLEE CLUB

The glee club has always been one of the most popular clubs in school. Perhaps this is due to the leader or to the inherent fondness in every man's heart for "close harmony." Whatever the cause, each season is always successful and last year was no exception. The glee club has demonstrated its ability in many concerts and programs, all of which were characterized by members appreciation of the music and the finish with which the numbers were rendered.

Dr. Protheroe, the leader of the club, has been extremely kind in giving his time to the organization. Although a well-known director and teacher, he has found time to lead the club and the results are most evident. It is an inspiration for any one who can sing to work under his direction.

The glee club has many of last year's men back, but it needs quite a few Freshmen and Sophomores to fill the vacancies. All men who desire to try out for this club should report next Thursday at the Rehearsal. There is always a welcome, and room for good material.

### AMERICAN SOCIETY OF MECHANICAL ENGINEERS

On Friday, October 8, the A. S. M. E. and the W. S. E. held a joint inspection trip to the plant of Allis-Chalmers Co., at Milwaukee, Wis. Armour representatives totaled twenty-two senior Mechanicals and four Civils. We started at 9 o'clock on the North Shore Line at Adams and Wabash, and the party filled up a four-coach special train. We took the Skokie Valley Route and stopped a few miles beyond Niles Center to inspect one of the automatic substations which transform the 33,000 volts A. C. of the Public Service Co., to 500 volts D. C. for the trolley power. This is accomplished by transformers and a synchronous converter. All control is effected through relays, provision being made for every known situation, such as peak loads, overloads etc. We then proceeded on our way to Milwaukee stopping to inspect an interlocking tower and battery-charging station of the North Shore Line at the junction of the Skokie Valley and the Shore Line routes. When we arrived in Milwaukee six busses were waiting to take us to the Allis-Chalmers plant, where they gave us a royal feed and took our picture. The remainder of the day was spent in inspecting the plant. They manufacture large machines; pouring castings as heavy as 120 tons. All the shops use labor-saving devices wherever possible, these devices being almost a necessity when working on turbine casings whose overall diameter measures nearly 40 feet, or mine hoists weighing 56,000 lbs., etc. In the forge shop the 2500 ton hydraulic press was a feature unique to most of us. The electrical department also contained some interesting turbo-generator units, several of which were being tested as we passed through. Although not all of us attended it, the dinner at the athletic club that night was a success.

### ATHENIAN CLUB

A year and a half of earnest endeavor on the part of the members of the Athenian club has given it a prominent position in the social and fraternal activities of the school.

Prior to this year, the club's activities were limited by the business of organization; but, that accomplished, it has entered upon what promises to be a busy social season.

### FIRE PROTECTION ENGINEERING SOCIETY

The Armour Fire Protection Engineering society has embarked upon this academic year with greater plans for unification of the members of the fire protection engineering department.

This organization was founded to bring together more closely, those who have a common interest in fire prevention. Special speakers at our meetings offer an opportunity for the members to gain useful and interesting knowledge not found in the college curriculum.

The program for the year was outlined in

(*Continued on page 26*)

# ATHLETICS

## INTERFRATERNITY BASKETBALL SCHEDULE

Interfraternity basketball, which began early this year has been occupying the attention of the teams lately. Last year the Phi Pi Phi beat the Sigma Kappa Delta in the finals and are out to repeat this performance. The complete schedule is given below. John Urban is in charge of all interfraternity athletics.

Nov. 2, I—Sigma Kappa Delta
*vs.*
Rho Delta Rho
II—Theta Xi
*vs.*
Triangle

Nov. 3, I—Kappa Delta Tau
*vs.*
Phi Kappa Sigma
II—Sigma Alpha Mu
*vs.*
Delta Tau Delta

Nov. 9, I—Sigma Kappa Delta
*vs.*
Kappa Delta Tau
II—Theta Xi
*vs.*
Sigma Alpha Mu

Nov. 10, I—Rho Delta Rho
*vs.*
Phi Pi Phi
II—Triangle
*vs.*
Beta Psi

Nov. 16, I—Sigma Kappa Delta
*vs.*
Phi Kappa Sigma
II—Theta Xi
*vs.*
Delta Tau Delta

Nov. 17, I—Kappa Delta Tau
*vs.*
Phi Pi Phi
II—Sigma Alpha Mu
*vs.*
Beta Psi

Nov. 22, I—Rho Delta Rho
*vs.*
Phi Kappa Sigma
II—Triangle
*vs.*
Delta Tau Delta

Nov. 23, I—Sigma Kappa Delta
*vs.*
Phi Pi Phi
II—Theta Xi
*vs.*
Beta Psi

Nov. 30, I—Rho Delta Rho
*vs.*
Kappa Delta Tau
II—Triangle
*vs.*
Sigma Alpha Mu

Dec. 1, I—Phi Kappa Sigma
*vs.*
Phi Pi Phi
II—Delta Tau Delta
*vs.*
Beta Psi

Dec. 8, I—Winners of I and II championship game

## OUR VARSITY CAPTAINS

### Track

Fred D. Payne

When something happens at the Armour Institute of Technology among the students, regardless of its nature, you can depend upon it that F. D. Payne will be there. Of course, this statement is subject to the limitations imposed by his personal tastes in student activities, which may be said to be

Fred D. Payne

specifically inclined toward track. In becoming acquainted with Payne, one will observe that he is rather hard to satisfy as well as inclined to upset things. As a concrete instance, he was not content with winning one letter. Instead, he earned three, and his athletic career has just begun. He encountered the one-half mile record which had been standing since 1907, and broke it during his sophomore year. In the year previous to this event, he established a two-mile record, and for lack of competent competition, broke it four times during the last year.

He was a member of the first team from Armour which had ever won medals at an Illinois relay.

We are not making any mention of his prowess on our own track in student-body meets. It is unnecessary to talk about familiar subjects.

If you were to ask Payne what his specialty is, he would undoubtedly tell you that it is in running two and one-half mile, mile, and one-quarter mile events. If you were to ask us, we would say that he specialized in being a leader and promoter of student activities, and a thorough-going good fellow. —*W'm. W. G.*

---

At a meeting, held in October, of the Interfraternity Athletic Council, it was decided to discontinue the playing of league ball and substitute a softball game tournament, in the spring. It is expected that this change will make the games more enjoyable and that a greater number of the fraternities will have teams in the tournament.

The present cup for baseball was awarded to the Phi Pi Phi who have won two of the three times necessary to obtain permanent possession of the trophy.

## SOPHOMORE-FRESHMAN TRACK MEET

The annual sophomore-freshman track meet held on Ogden Field the afternoon of Oct. 8, was won by the Sophomores with a score of 47 to 25. The high point man of the meet was Finlayson, a new man at school, from Morton Junior College, who ran with the Sophomores. Several men were out who should do good work on the team next spring in Varsity track. The results of the meet follows:

100-yd. Dash
S—Sturm
S—Finlayson
S—Kloepper, 11 sec.

Mile Run
S—Michelson
F—Smith
S—Grochowski, 5:34

440-yd. Run
S—Finlayson
F—Spencer
S—Kloepper, 1:04

880-yd. Run
S—Michelson
F—Smith
S—Grochowski, 2:44

Shot Put
S—Yount
F—Montgomery
S—Sturm, 31'11"

Discus
S—Yount
F—Montgomery, 89'

Broad Jump
S—Finlayson
F—Lewis
F—Trogwitz, 17'1¾"

High Jump
F—Lewis
S—Finlayson (tie for 1st)
F—Trogwitz, 5'2"

---

## VARSITY BASKETBALL

The basketball team has been practicing for some time in the Armory at 35th Street and Giles Avenue. Gale Morgan, captain-elect of this year's team, has not returned to take his place.

Prospects look good for the success of the team this year in that three "A" men, Kuffel, Augustine, and Eisenberg, are back. In addition, there are a number of subs, and new men for Coach Romney to work with.

---

## TRACK

In that Coach Phalen left Armour this summer, the cross-country team returned this fall without an advisor. It was decided, however, that Captain Payne was to take over the actual coaching of the team. The schedule is as follows:

October 30—North Central College
November 13—Lawrence College, at Appleton, Wis.
November 20—Lake Forest, and Bradley Tech., at Lake Forest (tentative)

The meet with Y.M.C.A. College is yet to be arranged.

(*Continued on page 28*)

# ENGINEERING NEWS

## THE DELAWARE RIVER BRIDGE

### The World's Greatest Suspension Bridge

On July 1, 1926, the century-old idea of building a bridge across the Delaware River between Philadelphia and Camden, was realized. On that day the Delaware River Bridge was officially opened to the public—the same day on which it was predicted that it would be completed back in 1919, when actual work was commenced on the huge structure.

The Chief Engineer who directed this undertaking is Ralph Modjeski, builder of over a dozen world-famous bridges, and the world's foremost bridge engineer.

Resulting as it does from the expenditure of many millions of dollars and the engineering skill that a century of progress has developed, its design and construction embodies many distinctive features. Included among these is the longest span of any of the great suspension bridges — 1,750 feet long from tower to tower. On each side of this central span there is a shore span 751 feet 8 inches long. The total length of the bridge, including the approaches, is 9,500 feet, just a little short of two miles.

The design of the anchorages and the towers is marked by extreme simplicity, the former being built of concrete with granite facings into which has been carved the coats-of-arms of the two cities and the two states which co-operated in building the bridge.

The two main towers are built entirely of massive plate-steel box sections, rising 385 feet above the water. The special silicon steel used, has an ultimate strength of 80,000 to 90,000 pounds per square inch, and a minimum yield point of 45,000 pounds per square inch. The machining of the sections of these towers required two of the largest rotary planers ever constructed—each having a head 108 inches in diameter, with 108 cutting teeth.

The problems connected with its construction were so varied that an immense amount of preliminary work was necessary before even the design could be started. The U. S. Geological Survey made a special study, covering a period of two years, of the Delaware River at the site of the bridge, mapping the currents and the seasonal variations of the river at that particular location in order that proper precautions could be taken to protect the caissons for the towers and anchorages. This was very important since these caissons are perhaps the largest ever constructed. For each anchorage two rectangular caissons and twelve circular were used. The rectangular caissons for the Camden anchorage were 40 feet by 140 feet in plan and 102 feet deep. They perform the heavy duty of transmitting to the bed rock the thrust from the main cables.

The height of the bridge proper was also the subject of considerable preliminary study by the War Department. A permit was finally issued which specified a clear span between pierhead lines and a clear height of 135 feet above high water for 800 feet at mid-river.

No other members of a suspension bridge are quite as important as the cables, since the entire live load of the structure is transmitted by them to the towers and the bed rock at the anchorages. It has been customary in the past for bridge engineers to specify four cables, particularly where the bridge is to sustain heavy loads with a large margin of safety. The Manhattan Bridge, for instance, has four cables, each 20¾ inches in diameter, while the sizes of the four cables on the Brooklyn Bridge and the Williamsburg Bridge are 15½ and 18¾ inches, respectively.

Mr. Modjeski has introduced a radical change in the design by utilizing only two cables, which necessarily are of great size. The maximum live load per lineal foot of bridge has been calculated to be 12,000 pounds, and in addition to this the immense weight of the structure itself must also be supported by these two cables, 30 inches in diameter, and by 596 suspender cables, each 2¼ inches in diameter, with a breaking strength of 214 tons each. Over 25,000 miles of wire were used in constructing these cables; the weight of the wire alone being 7,400 tons. Each great cable has a tensile strength of over 118,000,000 pounds, or 223,000 pounds per inch. Either of them could easily lift the *Leviathan*, weighing 54,000 tons, clear of the water.

The weaving of these cables was done on the job and was a task that assumed enormous proportions. The cable was constructed by arranging the wire in 61 strands of 306 wires each, making a total of 18,666 wires in the cable. Some idea of the magnitude of the task can be gained when it is remembered that all these wires had to be parallel, without twist, throughout the entire length of the cable, which was 3,540 feet.

The original diameter of the cable, after being completed, was 35½ inches, but by using a hydraulic compressing frame mounted around the cable, and capable of exerting a radial pressure of 30 tons, this diameter was reduced to 30 inches.

The over-all width of the bridge is 125 feet 6 inches. The roadway in the center for vehicular traffic is 57 feet wide from curb to curb. Just outside the roadway are tracks for two trolley lines. Outside of these trolley tracks the trusses, from the cables, that support the structure are fastened to the floor beams. The width, from truss center to truss center, is 89 feet. The floor beams extend 18 feet 3 inches beyond the trusses, acting as cantilever beams in supporting the tracks for two rapid transit lines. One ten-foot wide walk on either side of the bridge is carried by cantilever beams extending outward from the vertical trusses. At the center of the central span, the foot-walks are about 20 feet above the road level. To date only one of these walks has been completed.

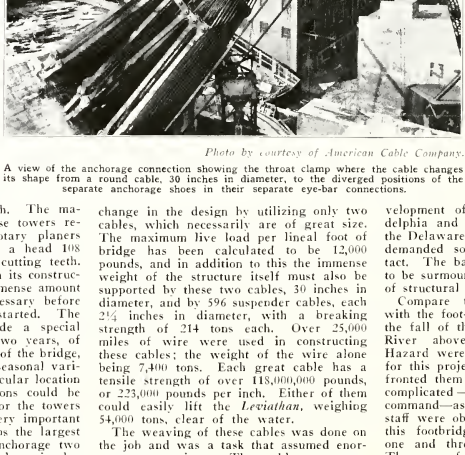


*Photo by courtesy of American Cable Company.*

A view of the anchorage connection showing the throat clamp where the cable changes its shape from a round cable, 30 inches in diameter, to the diverged positions of the separate anchorage shoes in their separate eye-bar connections.

The complete cost of the bridge was $37,211,000. Of this, the main bridge itself, from anchorage to anchorage, cost about $15,000,000; the Philadelphia approach cost over $5,000,000, while more than $3,500,000 was required for the Camden approach. The engineering cost was very reasonable compared to the other items, being $1,500,000. When all these expenses are added to the $11,300,000 required for the real estate upon which the approaches have been built, the tremendous expenditures which the bridge necessitated will be readily appreciated.

The rapid economic development of the two great cities, Philadelphia and Camden, on opposite sides of the Delaware River, and of the nation itself, demanded some convenient means of contact. The barrier offered by the river had to be surmounted, and this modern highway of structural steel was the result.

Compare this latest engineering effort with the foot-bridge which in 1812, spanned the fall of the Schuylkill, on the Delaware River above Philadelphia. White and Hazard were the two engineers responsible for this project, and the problems that confronted them at every turn were almost as complicated — with the facilities at their command—as those which Modjeski and his staff were obliged to solve. The cables of this footbridge, made of six wires, were one and three-eighths inches in diameter. The span of the structure was 408 feet and the cost was the modest sum of $125. A toll of one cent was charged for passage. It finally broke apart during a severe winter a few years later.

Such is the story of the Delaware River Bridge; a story which illustrates well the engineering progress of a country and is typical of the engineering age in which we live.

## LARGE WELDED TRUSSES UNDER TEST

A series of four roof trusses was tested to destruction during the week of May 10, 1926; the culmination of a year's intensive study of the proper application of oxy-acetylene welding to the fabrication of steel structures.

As a first step, studies were made of various types of joints in various kinds of steel shapes. A few of the most promising schemes were then built into typical truss intersections, and proper jigs built to load these joints to destruction. Unit stresses for weld metal in tension, compression and shear were determined by this means. The variety of joint known as the "plate insert joint" was shown to have marked advantages.

Next, a 40-foot roof truss was designed and built of conventional angle-iron sections, using the information gained by this preliminary work. In testing, very elaborate framework was necessary to give the upper chord of the truss the lateral support it would receive when placed in a building. Platforms were hung from each panel point and loaded with pig iron.

At definite increments of load, the stresses in each member were measured by an extensometer. At double the design load, each welded joint was vigorously pounded with a heavy hammer. At 3½ times the design load, the truss failed by buckling in the upper chord—no distress at any welded joint was in evidence. At the time of failure the truss designed for a load of 21,000 pounds, was carrying 75,000 pounds of pig iron.

Having thus demonstrated the soundness of the underlying methods, four trusses were prepared for comparative test. One was riveted; another was welded, using members of the same size from the same mill rolling; the third was designed to have the same strength as the riveted truss, but since the oxy-acetylene welded joint allows a better placement of the metal, it was materially lighter in weight. A fourth truss was welded of tubular sections.

A summary of the final result follows:

| Style | Weight | Total Load at Failure |
|---|---|---|
| Riveted Truss ..... | 1161 lb. | 62,000 lb. |
| Welded Truss of equal weight ..... | 1150 lb. | 72,000 lb. |
| Welded Truss of lighter weight .... | 1079 lb. | 70,000 lb. |
| Welded Truss of tubular sections ... | 916 lb. | 63,000 lb. |

All trusses failed by buckling of the top chord, a compression member. In no instance were there any signs of distress at a joint.

These tests were made under observation of engineers from the Pittsburgh Testing Laboratory, and in the presence of several independent observers and representatives of Government departments.

## THE STATE STREET ILLUMINATION

The 3150 feet which represents the length of State Street illuminated between Van Buren and Lake Streets has a lighting intensity of 2000 lumens per linear foot of street. This installation of 140-2000 watt lamps with a rated light output of 45,000 lumens per lamp means that over this business district will be thrown 6,300,000 lumens of light. For purposes of comparison the following street lighting intensities are cited:

| | Lumens per Linear Foot |
|---|---|
| State Street, Chicago..... | 2000 |
| Salt Lake City, Business section..... | 822 |
| Niagara Falls, Falls Street..... | 761 |
| San Francisco, Market Street..... | 750 |
| Schenectady, Erie Boulevard..... | 700 |
| Portland, Oregon, Business district.... | 600 |
| Schenectady, State Street..... | 585 |
| Indianapolis, Business section..... | 520 |
| Los Angeles, Broadway..... | 510 |
| San Francisco, Triangle district..... | 500 |
| El Paso, Business section..... | 500 |
| Cleveland, Superior Avenue..... | 500 |

This comparison shows that State Street will have 2½ to 4 times the lighting intensity of the best lighted cities in this country.

A great deal of research work was done in order to develop a lamp to meet the requirements of this installation. A suitable bulb, which from now on will be a standard lamp for base down burning, was the outcome of a series of tests and laboratory research work. This lamp, owing to its large radiating surface, lowers the possibility of glass distortion due to accessive heat developed by the burning filament, and in addition creates a pocket at the peak of the lamp where the carbon deposit is concentrated which results in the minimum cut-off of the upper rays of light given out by the lamp. The dimensions of this lamp are 16½ inches overall with a maximum diameter of 6½ inches. The glassware selected for this installation is known as the Novalux Rippled glass. This, as far as is known, is the largest glassware that has ever been made for street lighting purposes.

The installation is a combination of trolley pole and lighting standard. As a result of this combination there will be eliminated about 45 poles that are now installed on the street.

Considerable technical work was necessary in the development of the ornamental standard as the requirements of the Chicago Surface Lines were such that owing to corrosion, it would be necessary to make a periodical inspection of the trolley pole. To meet this requirement, an ornamental standard was developed whereby the 14 feet of shaft is constructed in two halves made of No. 11 gauge pressed steel. These halves are flanged and fastened together by machine screws, and when the equipment is installed it looks like a one-piece shaft. The object of using this type of construction was to eliminate the necessity of removing the trolley open wire attached to the top of the standard whenever it was necessary to make an inspection. By removing the machine screws by which these halves are fastened together, the shaft sections can be removed from around the trolley pole, and that section of the trolley pole painted and the base castings raised for an inspection of the base of the trolley pole and painting purposes.

As the street lighting system is located in what is known as the direct current district of Chicago, it was decided, in order to lower the installation cost, to connect these lights to the service stubs now installed in the curb walls on both sides of the street at the different points. This makes this lighting system a multiple 110-220-volt direct current installation. The control for this installation is centered at a point known as the East Madison Street substation, which is centrally located. The remote-control bus consists of three wires of positive polarity installed in ducts and extending along both sides of that section of the street to be lighted. At different points, taps are made from this control but to remote-control solenoid-operated circuit breakers. These circuit breakers are equipped with a closing coil and an opening coil. The three positive control wires are connected to the operating coils depending upon the operating hours of the post affected. One of these positive bus wires is used for closing purposes only. One of the other two is used for an opening control at 1:00 A. M. when 49 of these standards, or 98 of the lamps, are switched off. The other control wire is used for switching off 21 standards, or 42 lamps, at daylight. The return used as the other side of this operating bus system is the system-negative and no additional return wire is needed. This afforded a saving in labor and material.

For future capacity, required either by the necessity of installling increased wattages in case of greater development in street lighting intensities or in case of the desirability of installing additional decorative festoon-lighting for celebration purposes, there has been provided 2000 watts additional capacity in each one of these lighting standards, and a tap is made to the wiring, located in the urn at the top of the standard, by means of a fuse block where such capacity can be supplied.

The desirability of maintaining a vertical position of the standards at all times made special design necessary. A 31-foot trolley pole, 25 feet of which is above the sidewalk level, was determined upon. This trolley pole is 7, 8 and 9 inches inside diameter, and is made of extra heavy steel. The point of contact of the span wire is 24 feet from the sidewalk level, and the foot of pole above that point is used for securing and supporting the upper castings of the ornamental standard. Both the feed cables for the street lights, and that for the trolley system, is brought through the interior of this trolley pole from the base, which in most cases is imbedded in concrete. The point of contact to the lights and trolley overhead system is made at the extreme top of the trolley pole.

In order not to weaken the tensile strength of the trolley pole, no openings were made at any point of the pole tubing. Most of the feeders to the trolley overhead system are 500,000 circular-mill-capacity, 600-volt, lead covered cable.

The trolley poles were installed with a 4-inch rake until such time as the trolley span wire was connected when, owing to the strain, the poles assumed a vertical position. When the trolley poles assumed in a vertical position, the base of the ornamental casing was grouted, and the shaft trued to a vertical position.

The ornamental castings at the top are so constructed as to permit the egress of this cable in order that it can be attached to the span-wire feed to the trolley wires. No conduit or other insulation outside of the cable insulation is used in the trolley pole for cable protection. Where these trolley poles are set in concrete, means were provided by the installation of 2 ells in the base of the concrete pilaster or base which permits installing the wires or cables after the trolley poles were set. As most of the curb walls on the street are retaining walls, and the basements of the various buildings are excavated between the building line and the curb line, most of the control equipment was installed in this space adjacent to the foundation installed in the curb wall.

Past standards of construction required the installation of a box on the trolley pole itself in which was installed an air brake knife switch for control of the feeder to the trolley overhead. This switch, and its equipment, was considered unsightly and was objected to. In order to eliminate the use of this equipment, the standards of construction had to be changed. This was accomplished by designing a special air break switch which is installed in a metal cabinet and mounted on the underneathside of the sidewalk adjacent to the curb wall. The connections to this switch are made at this

*(Continued on page 28)*

# HUMOR

Fond Father: "How did you get through Calculus?"
A Want-to-Be-Engineer: "Don't know, Dad; went through there at night and didn't see much of the place."
—*The Transit.*

---

"My curiosity is running away with me," said the farmer when his two-headed calf broke loose and towed him around the barnyard. —*Rose Technic.*

---

Ras: "Boy! This ukulele, suh, am old. Why, it belonged to King Tut."
Tus: "Man! Dat ain't nothin'; I got Adam's apple." —*Transit.*

---

First Prep in Math Exam: "How far are you from the right answer?"
Second Prep: "Two seats."

---

Widow: "Yes, my husband's dead—killed by a traveling crane."
Englishwoman: "What shockingly horrible birds you do have in America."
—*Rose Technic.*

---

"Are you a trained nurse?"
"Yes."
"Well, let's see some of your tricks."

---

On a farm in South Georgia is posted this sign: "Trespaser's will be persksuted to the full exten of 2 mean mongral dorgs which ain't never been ovarly soshibil with strangers and 1 dubble barrel shotgun which ain't loaded with no sofy pillers. Dam, if I ain't tired of this hel raisin on my proputy."

---

### Can't Fool Hoss Flies

Two colored gentlemen were engaged in conversation when one of them became very much annoyed by the persistent attention of a large fly.
"Sam, whut kin' a fly am dis?"
"Dat am a hoss fly."
"Whut am a hoss fly?"
"A hoss fly am a fly whut buzzes 'round cows 'n hosses 'n jackasses."
"You ain't makin' out to call me no jackass?"
"No, I ain't makin' out to call you no jackass, but you can't fool them hoss flies."

---

### The Road to Wealth

An engineer started his career twenty years ago as poor as the proverbial church mouse. He has now retired with a fortune of $50,000.
This fortune was acquired through economy, conscientious effort to give full value, and indomitable spirit, and the death of an uncle who left him the small sum of $49,999.50. —*Auburn Engineer.*

---

Ethel was sitting on the sofa with a young man friend of hers. On her knee was her little niece. The door to the next room—which was full of people—was wide open. The folks in the other room heard this:
"Kiss me, too, Aunt Ethel."
"Certainly, dear, but don't say 'two.' Say 'twice;' two is not good grammer."

Pat, newly landed, was hired in a lumber office. The proprietors were young men and decided to have some fun with the new hand. Pat was left in charge of the office, with instructions to take all orders which might come in. Going to a nearby store, they called up the office and the following conversation ensued:
"Hello! Is this the East Side Lumber Co.?"
"Yes, sir."
"Please send me up a thousand knot holes."
"What's that?"
"One thousand knot holes."
"Well, now an' ain't that a bloomin' shame. I'm sorry but we are just out of them."
"How's that?"
"Just sold them to a brewery."
"To a brewery? What do they want with them?"
"They use them for bung-holes in barrels."
—*Iowa Engineer.*

---

### Politics

Bones: "Last night when I got home my wife had my easy chair all ready, my slippers at hand, my newspaper and my pipe—."
Beans: "How did you like her new hat?"
—*Union Pacific.*

---

Son: "I was the only one who could answer the question that the teacher asked this morning."
Mother: "I'm proud of you, my boy, for being so attentive and so eager to learn. What was the question?"
Son: "Who threw the eraser?"
—*Auburn Engineer.*

---

### Humor

"That doesn't sound so good," as the drowning man said when he struck bottom at 20 feet.

---

"Don't make any passes at me, boy, 'cause if you get me roused, you'll be aged in the wood."

---

J.R.G.: "I'm afraid this concrete highway will have to be condemned."
F.D.P.: "Why?"
J.R.G.: "Because it's in the road."

---

"How did you find the weather in Florida?"
"Easy! It was just outside the house."

---

Soph: "G'wan, you've got hayseed in your hair."
Frosh: "That isn't hayseed, that's wild oats."

---

"Here's where I shine," said the pledge, as he got down on his knees to wax the floors.

---

Glen O.: "I see you have a new fur coat."
Don S.: "Yes, I killed the wolf at the door."

He: "Why does an Indian wear feathers on his head?"
She: "Why, I guess to keep the wigwam."

---

The most reliable lads in the world are college men—there never seems to be a bit of change about them.

---

Prof. C.: "What animal makes the nearest approach to man?"
P.H.: "The mosquito."

---

Dick O.: "The weather makes me feel so foolish."
Mary Jane: "Oh, it's the weather, is it?"

---

Moon: "What was that joke about that Prof. Rob. told in class?"
C.S.: "I don't know. He didn't say."

---

### HEY! HEY!

### Our New Field Book

Discouraged

The woodpecker wept in deep dismay
As the shades of evening stole,
For he had been pecking all the day
At a cast-iron telegraph pole.
—*Disston Crucible.*

---

### Another Divorce?

The following notice was posted in the Post Office in a logging camp in the State of Washington:

NOTICE—A REWARD

DOG—Lost or Stolen Nov 18 A White Pointer Bird With Light Tan Ears and Cheaks with a Small Round Spot In His Forhead and one Across His Tail Where The Tail Leaves the Body.
—*American Forests and Forest Life.*

---

### Or Sat Near One in a Meeting?

"What becomes of all the brown autumn leaves?"
"Haven't you ever smoked a five-cent cigar?"
—(*Forestry Dept.*), *Maryland News-Letter.*

---

### One on Father

Father: "Did you tell your prof that I helped you with your Calc, Tom?"
Tom: "Yes."
Father: "And what did he say?"
Tom: "He said he wouldn't flunk me this time, 'cos it didn't seem fair I should suffer for your ignorance."
—*Parsons Magazine.*

---

### A Natural Question

Battered Motorist (waking up): "Where am I? Where am I?"
Nurse: "This is number 116."
Battered Motorist: "Room or cell?"
—*The New Yorker.*

---

### Must Be a Senior

Professor: "I shall call on you again, tomorrow."
Student: "Yes, do. It's a pleasure to encourage an optimist like you."

# —but why choose your life-work that way?

YOU'D laugh at a man who couldn't make up his mind which colors to back. But isn't that about the way a good many men start out on their careers?

All through college the most important study a man can select is himself — to find out by self-analysis and experience what is his particular aptitude and what work he should get into after college.

It's a good rule to talk this over with the faculty and with men out in industry to get all the guidance you can in "finding yourself" — because your whole happiness and effectiveness in your career is at stake.

*Published for the Communication Industry by*

**Western Electric Company**

**Makers of the Nation's Telephones**

*Number 63 of a Series*

## COLLEGE NOTES

(Continued from page 18)

At the junior class election, the following men were elected:

*President*.....C. A. GUSTAFSON
*Vice-President*.....L. J. ANDERSON
*Secretary*.....W. D. ALLEN
*Treasurer*.....M. B. TRACY
*Social Chairman*.....A. TULLY

---

J. W. URBAN, the senior president, presided at the organization classmeeting of the freshmen held on Friday, October 8. At this meeting Mr. Lamm, editor of the *Cycle*, and Mr. Gothard, editor of the ARMOUR ENGINEER, told the freshmen the reasons for the existence and ideals of these two publications. It was pointed out, by these two men, that the way to prepare for major staff positions is to join the Press club, where opportunity is given everyone to do publication work and develop hidden talent.

The officers were to have been chosen at this time, but due to the large number present, and the inevitable confusion, only the following were elected:

*President*.....D. J. PAUL
*Vice-President*.....C. T. SOMMERVILLE

---

The city of Muskegon is the worst in the world in which to find ones way about, if we are to believe reports of the six members of the present senior class in chemical engineering who spent the summer there doing special research work in the laboratories of the Brunswick-Balke-Collender Company. Much of the time was spent on lacquers, casein plastics, and billiard chalk. Also, no little time was devoted to tracing the path of a billiard ball across the table.

---

During the summer vacation period, the class rooms in Machinery Hall have been given a most thorough cleaning up, and Chapin Hall has been entirely redecorated. The placing of the small tables in the lunch room makes a meal eaten there much more enjoyable than formerly.

---

## FRATERNITIES

(Continued from page 19)

Sigma Kappa Delta men have returned *en masse* with renewed vigor and enthusiasm to carry onward the spirit of loyalty and honor for our Alma Mater which has always been identified with Sigma Kappa Delta men. This year, we hope that we may uphold this spirit which has predominated in all our relations and activities at school.

The Sigma Kappa Delta goal has been the development of personality and character through activity in diversified interests in school and fraternity life. Whether it be scholastically, athletically, socially, or in fact, any endeavor whatsoever, the personal benefit derived will depend upon the energy and ambition expended in its attainment.

So, with this in mind, we are beginning this year with the expectancy of bigger and greater accomplishments than ever before.

---

## TRIANGLE FRATERNITY

Triangle men plunged right into work this year and our house certainly looks the part. Such scrubbing, cleaning, scraping, painting, varnishing and story telling has never before been done. Naturally, every fellow in the bunch had some extra special gag to pull, and most of them were pulled to perfection. The wallpaper came down and the paint went on, so everybody's happy despite the bum jokes.

Triangle fraternity extends a most sincere hand of welcome to the latest edition of Freshmen. We have an idea that the upperclassmen have got to do some "super-stepping" to out-step this class. Perhaps the idea will become more general when the Freshman class begins to make itself known around the campus. In any case, Triangle welcomes you, Freshmen.

We lost some of our members by graduation, but a mighty live group is present. Parties have been planned and several of the fraternity men are more than ordinary musicians, and the prospect of a mighty snappy orchestra is very promising. One thing, however, it is exceedingly hard to play an instrument and enjoy oneself at the same time. Besides, the girl friend doesn't like it at all! Engaging another orchestra always solves this difficulty, however.

There are big doings this year. The annual convention will be held at Chicago, again. Armour chapter played the part of the host last year, with the result that the convention decided to meet here this year.

An important item is that the National Council has met at the Armour chapter house, recently. We are very glad that this chapter has had the opportunity of helping the Council.

The Active Association of Armour chapter wishes all kinds and forms of success to our recently graduated brothers. They're real engineers, now, and we're proud of them.

---

## PHI PI PHI

The majority of the undergraduates of Gamma of Phi Pi Phi have returned to their Alma Mater. We regret that five of our undergraduates found it impossible to return at this time.

Plans for social activities were laid, which resulted in a dance at the house on Saturday, October 9. Under the leadership of our social chairman, Bill Scholz, entirely new features of decoration were presented. Not a few of the Alumni were present at this first function and all agreed that it was a *different* party.

The following October 13, brought forth a smoker given at the chapter house. Impromptu entertainment was rendered by the more talented brethren and great were the regrets when the affair drew to a close.

At this moment we take great pleasure in announcing the return of "Johnny" Edstrand to pledgeship in the fraternity. Due to circumstances over which he had no control, he dropped during the last year. In addition, we have pledged: G. H. Smith and C. Gatons.

To the incoming Freshmen class we extend our best wishes for a good year and to our old friends we drop a word of good cheer for your continued success.

---

## RHO DELTA RHO

Rho Delta Rho has taken up its new quarters at 3333 Michigan Avenue. When roll was called, at the opening of the school year, all were present, fully rested and full of pep, with the exception of Brother H. Freed, who was unable to return from his home in Omaha. We hope to see him back soon.

We opened our social season with a smoker at the Morrison Hotel, Friday evening, October 8. All the actives were present, as were most of the Alumni. Bob Minkus was there with a good line of stories and became the center of interest, for a while. Tavlinsky and Cohen impersonated several stage characters with a certain degree of success. The fellows were unanimous in their applause; but there is some doubt as to whether it was for our two brethren or in sympathy for the characters they impersonated. At any rate, the affair was a huge success.

---

## BETA PSI

The birth of the Beta Psi national fraternity came with the formation of the Club Sodales. Sodales, meaning companions, was symbolic of the club itself. Those belonging to the club were companions. The feeling between the members was that feeling which would be expected of the members of a Greek letter fraternity. Thus Beta Psi came to be formed.

---

## KAPPA DELTA TAU

The Kappa Delta Tau fraternity, by dint of co-operation among its members, boasts a sound footing and a bright future. A spirit of loyalty pervades the fraternity, and is well shown by the continued activity to advance it in the annals of school fraternalism.

At a recent social function the fraternity presented a loving cup to Joel Jacobson for having obtained the highest scholastic record in the freshman class of Armour Institute for the year 1925-26.

In 1924, there were four student members at Armour Institute. The student membership is now twelve, and the outlook for new members is right.

Our alumni work hand in hand with the students, both groups meeting at the fraternity house, 3311 Michigan Avenue. About twenty alumni are present at our meetings, held every two weeks.

---

## SOCIETIES

(Continued from page 20)

### FIRE PROTECTION ENGINEERING SOCIETY

the first meeting held October 7. Meetings will be held the first and third Thursday of every month. Prominent men in the field of fire prevention and insurance will address these meetings.

Officers of the society are:

*President*.....C. LONG
*Vice-President*.....R. G. OSGOOD
*Secretary*.....R. S. WALSH
*Treasurer*.....W. H. ALEXANDER

---

### THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS

The Armour student branch of the A. S. M. E. is looking forward to a lively and successful year, insomuch as it has made a good beginning. The first meeting was held October 7, and Professors Giebhardt, Peebles, Roesch, and Huntley gave short talks on the purpose of the society, and the benefits to be derived therefrom. On Friday, October 8, the society accompanied a joint excursion of the A. S. M. E., the A. I. E. E., and the W. S. E., to the Allis-Chalmers plant in Milwaukee. Dean Potter, of Purdue, gave a very inspiring talk to the society on October 13, on the essentials of success for the engineer.

(Continued on page 28)

# A SUGGESTION FOR YOUR THESIS OR FOR OTHER INDEPENDENT RESEARCH

Perhaps no branch of mining appeals to the imagination as much as blasting. The mere mention of dynamite will usually cause a thrill of interest. Courses that treat of this subject are always fascinating to the student.

But because of the many subjects that must be covered in an engineering course, it is seldom possible to include a comprehensive course in Explosives Engineering. Until a short time ago the importance of this branch of engineering was not recognized. Blasting was carried on by blasters without the direction of engineers.

Now, however, the mining companies and construction companies are looking for men who know how to move material with explosives efficiently. It is not enough to move the material. The Explosives Engineer must know how to move it at the lowest cost.

Through a monthly publication, The Explosives Engineer, and through numerous booklets on blasting and explosives, the Hercules Powder Company provides material for interesting reading that will be a valuable supplement to your regular studies. A study of Explosives Engineering will suggest many subjects for theses, or for other independent research; and you will be well repaid for the time spent on this branch of engineering when you enter upon the active practice of your profession.

***HERCULES POWDER COMPANY***
*(INCORPORATED)*
**Wilmington Delaware**

MANY discerning engineering students are preparing themselves for future promotions *now* by reading The Explosives Engineer, regularly. And they are finding that this foresight does not involve arduous effort. Anyone wishing to learn more about mining, quarrying and construction will derive pleasure as well as profit from the carefully edited, authoritative articles and from the many photographs, drawings, paintings, and other illustrations.

Each issue contains a bibliography of everything published in the technical press of the world, relating to drilling and blasting.

Supplement your classroom instruction with this wealth of useful information from men who are now occupying the jobs to which you will some day aspire.

*Mail this coupon for a free sample copy.*

THE EXPLOSIVES ENGINEER,
941 Delaware Trust Building,
Wilmington, Delaware

Please send me a free sample copy of The Explosives Engineer.

NAME

STREET

CITY

STATE

## SOCIETIES

(Continued from page 26)

The society plans to have many such talks by men prominent in engineering circles, as well as talks by students. To these meetings the Freshmen and Sophomores are invited. All junior and senior mechanicals are expected to enroll and to actively support the meetings.

The officers for the ensuing year are as follows:

*President*.....K. Figenbaum
*Vice-President*.....W. Schroeder
*Treasurer*.....H. R. George
*Secretary*.....R. P. Petersen

## AMERICAN INSTITUTE OF CHEMICAL ENGINEERS

The first business meeting of the year was held on Thursday, October 7. Quite a number of junior and senior Chemicals were on hand to participate in the hand shaking and the pie slinging. After the dust had settled, it was found that the following gentlemen (or what would you like to call them?) had been awarded the sprig of comely columbine denoting their new official capacities:

*President*.....J. W. Urban
*Vice-President*.....F. O. Johnson
*Secretary*.....G. C. Dufour
*Treasurer*.....T. P. Camp
*Chairman of Program Committee*.....
.....J. J. Doheny

Through a rather ingenious application of *physical* chemistry, a scheme was finally adopted whereby the vice-president has something to do.

Several other meetings have been held, including a departmental meeting, and it is the aim of the present officers to maintain the high standard of programs that the innocents have been exposed to during the last few years.

## ATHLETICS

(Continued from page 27)

### GOLF

Under the leadership of Captain Wesley Miller, the Armour golf team concluded a very successful series of matches just before the close of school in June. The high light of the schedule came as a result of a close victory over the strong Notre Dame team. The play was at South Bend, over the difficult but sporty Erskine Park course, and under the meanest possible weather conditions. In the morning Miller, shooting against Captain Adams of Notre Dame, came in with a 37-38-75, three over par, to notch two points. In spite of this, however, Notre Dame was leading 8 to 4 at the luncheon interval. In the afternoon, all of the boys started to get into the game, and it was only due to the best ball of 35-33-68 turned in by Miller and Urban that our team was able to outpoint their opponents, 12-10. This is the first time Armour team has beaten Notre Dame in any sport.

During the second week in June, a joint golf and tennis banquet was held at the Lakota Hotel. John Schommer was on hand with a bunch of good stories to brighten up the evening. At this time John Urban was elected captain of the 1927 team. The good part about the whole thing is that all five-letter men will be back in the spring so the team will be stronger than ever.

The Fall Golf Tournament will be completed by the time this is printed. As yet, it is early to tell if there is any promising material in the Freshman class. Twenty-two entries were received, however, which is the largest entry list so far.

### INTER-FRATERNITY TENNIS

The Triangle fraternity won the inter-fraternity tennis tournament by virtue of their victories over the teams representing the following fraternities:

Theta Xi ..... 3-0
Sigma Kappa Delta..... 2-1
Delta Tau Delta..... 2-0

The Triangle team was composed of Harrower, Langdon, and Chandler.

The meet was an elimination affair. That is, once a team was defeated, it was out of the running. Not all of the scores are available, but the following are given:

Phi Kappa Sigma..... 3
Rho Delta Rho..... 0

Delta Tau Delta..... 2
Phi Kappa Sigma ..... 1

Sigma Kappa Delta..... 3
Phi Pi Phi..... 0

Sigma Kappa Delta ..... 3
Sigma Alpha Mu ..... 0

## ENGINEERING NEWS

(Continued from page 23)

point for the overhead and to the underground feeder of the city railway system. This metal cabinet which encloses the switch is constructed so that it will drain off any moisture which may be caused by condensation or from other sources.

The switch itself is hand operated by a handle which extends through the sidewalk to a point which is level with the surface of the sidewalk. A screw cap is installed at this point which can be readily removed in case the operating requirements are such that the switch should be opened. This feature eliminates the necessity of a man on trouble work, from entering the basement of the different stores at inopportune times.

The anchorage of these trolley poles is in most cases in concrete, but owing to conditions beneath sidewalks, it was found necessary in several instances to use a heavy cast-steel casting, known as a pole-pot. This was anchored, by means of "U" bolts, to eye-beams which support the sidewalk, and are attached to the various steel structures.

The promotion of this installation was inaugurated by an organization called the State Street Lighting Association. An agreement was drawn between the Association and the property owner or tenant. This agreement pledged the cooperation of the person or corporation signing it, and required the payment of $12.54 per front foot per year for the first five years, and $7.76 per front foot per year for the second five years. The amounts subscribed on this basis are somewhat in excess of the amount required for actual financing, but provided a reserve to take care of contingencies.

After sufficient frontage was secured on this basis, the Association entered into a contract with the Commonwealth Edison Company for the installation, maintenance, current, and lamp renewals for a ten year period. The State Street Lighting Association was incorporated under the laws of the State of Illinois, and is a corporation not for profit. Mr. Elmer T. Stevens of Charles A. Stevens & Brothers is president, and the directors consist of the heads of most of the leading merchandising companies on State Street.

## RADIO BROADCASTING CHANGES

The Supervisors of Radio have reported to the Department the changes which have taken place in their district between October 15 and November 1. The changes during this period have been included in the figures submitted in the previous report of October 15. The statement below shows the total for the combined periods.

The following changes during the last two weeks are shown in the table:

New stations have increased from 63 to 75.
Changes in location from 25 to 26.
Increases in power from 63 to 76.
Changes in wave length from 62 to 74.
Stations under construction, 40 to 70.
Preparing to increase power, 46 to 50.
Those having more or less indefinite plans increased from 82 to 110.

Of the new stations licensed since the 1st of July, reports indicate that 17 of these stations are equipped to use power of 500 watts or more and that there are 13 of the old stations which were licensed before the 1st of July, which have increased their power to 500 watts or more.

## GOLDEN GATE ORDERS THREE DIESEL ELECTRIC FERRY BOATS

The Golden Gate Ferry Company, who will add three new Diesel-electric ferry boats to their fleet in San Francisco harbor, have awarded a contract for a total of nine six-cylinder, 400-brake horsepower marine solid-injection oil engines.

The new ferry boats, which are to embody the latest idea of ferry boat design, will be 240 feet long and cost an approximate total of $1,325,000.00. Each ferry boat will have a capacity for 85 automobiles and hundreds of passengers. They will be of the double-ended type, and the two propulsion motors, one located aft and the other forward, will be directly controlled from the pilot house.

Three oil engines will be installed in each boat and each will be direct-connected to a generator and exciter. The engines, which are of the multi-cylinder, 14-inch bore, 19-inch stroke, solid-injection, four-cycle, single-acting type, will operate non-reversing and run at 265 revolutions per minute.

Electric power will be generated by these oil-engine generating units for the forward and aft propulsion motors, motor-driven pumps and ship auxiliaries, electric lights and conveniences, searchlights and pilot house control.

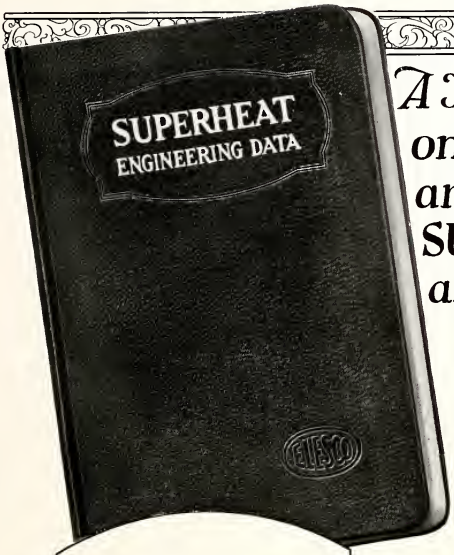
Each propulsion motor will be of sufficiently high rating to propel the ferry boat. The load will be switched from one motor to the other when making the return voyage. The aft motor will thus always be used for propulsion while the forward motor will drive its propeller just fast enough to avoid any resistance.

The oil engines selected for the new ferry boats are the same type as the marine oil engines recently purchased for Diesel-electric ship propulsion by the Panama Canal Commission, Atlantic Refining Co., and the Long Island Railroad.

## GLYCERINE COMPARED WITH ALCOHOL AS AN ANTI-FREEZE SOLUTION

In order to compare glycerine with alcohol under actual service conditions, the following test was conducted by engineers of The National Glycerine Service: A number of cars, both of the water pump and the thermo-syphon circulating type, were filled with a 35%, by volume solution

(Continued on page 36)




# A Handbook on the Generation and Use of SUPERHEATED STEAM and related subjects.

*Just Published*

THIS HANDBOOK is for steam power plant engineers and operators. It contains condensed data, well indexed for ready reference. Superheat Engineering Data is not intended to displace standard handbooks. But it is different. Much of the information it contains can be found in no other single publication. For instance, practically all types of stationary boilers commonly made in America are illustrated and brief comparative data is given as to sizes, tube sizes, arrangement of tubes, etc. In fact, much of the data has not hitherto been published and because of its character, one would have difficulty in securing it unaided.

*Some of the Data Contained in the Book*

Superheated steam, its advantages over saturated steam and the proper design and performance of superheaters.

Superheated Steam for Heating.

Cylinder Lubrication with Superheated Steam.

Superheater arrangements are illustrated for all types of boilers for stationary, marine and locomotive services, including waste heat, portable and separately fired superheaters.

Data required to design stationary superheaters.

Steam Tables covering pressures from below atmospheric to 600 lb., absolute, including properties of superheated steam from 50 to 300 deg. F., superheat.

Specific heat of superheated steam.

Reduction of superheat due to moisture.

Complete information for figuring piping for handling water, saturated and superheated steam. Piping data includes proposed American Standard for high pressures. Also velocity and pressure drop of water and steam flowing through piping.

Engineering data on coal and oil fired boilers, including tables giving heat value of gaseous, liquid and solid fuels.

Data on bolts and screw threads, including recent work of American Engineering Standards Committee and National Screw Thread Commission.

Conversion Tables.

Many miscellaneous tables commonly used by steam engineers.

*Printed on good quality paper and bound with a flexible Keratol cover. 85 illustrations and diagrams. 69 tables. Size, 4½ x 7 in. 208 pages.*

**Price $1.00**

*Send for your copy today.*

THE SUPERHEATER COMPANY

17 EAST 42ND ST. NEW YORK — ELESCO — PEOPLES GAS BLDG. CHICAGO

Canada: The Superheater Company Limited, Montreal

Students wishing copies, apply to ARMOUR ENGINEER

## A SOUTH SIDE RETROSPECT

(Continued from page 7)

the bank was lined with grain elevators and lumber yards as far south as Eighteenth Street, but the great lumber market of today along Twenty-second Street was little more than a swamp. Between Archer Avenue and the river there were a number of packing houses, rendering plants, etc., extending as far as Bridgeport, near Thirty-fifth Street. This was a time of arrogant individualism and determined go-as-you-please in the conduct of industry. It is not surprising, therefore, that Bridgeport was a noisome suburb, where one encountered all the olfactory abominations conceivable in the mind of a careless butcher. Happily, Bridgeport as it was in the Sixties is no more, the packing industry having been brought to a level of sanitation and cleanliness never dreamed of on "Archy Road."

South of Twenty-second Street and from State Street west to Halsted and beyond, lay a great tract of practically empty land belonging to "Long John" Wentworth. He had come to Chicago in the Thirties and had acquired much of this land for less than the proverbial song. In 1865, he sold to a group of men headed by John B. Serman, 320 acres on Halsted Street near Forty-second Street, for $100,000. These men organized the Union Stock Yards and Transit Company, and on the land which they had bought, established the stock yards as we know it today. Wentworth belonged to a group of early Chicagoans who amassed substantial fortunes in the natural appreciation of real estate values in a fast-growing city. To them the political economist, sitting in his easy chair and discoursing on the unearned increment, seemed little better than an anarchist, an enemy of the state and a defamer of the constitution.

In the great fire of October, 1871, practically the entire business district of the city was destroyed. But soon from the still-smoking ashes Chicago began to arise again, phoenix-like, greater and more beautiful than before. It was then that the South Side began to come into its own as a desirable place of residence; Michigan, Indiana, and Prairie Avenues began to fill rapidly with the homes of Chicago's captains of industry. George Armour, Marshall Field, Edson Keith, George M. Pullman, and others, built their residences on Prairie Avenue. A little later there came William Armour, Philip D. Armour, Horatio O. Stone, Walter W. Kimball, Marvin Hughitt, and many more whose names were household words in Chicago. These were the men who, in a very literal sense, laid the foundations of the city as it is today.

On Michigan Avenue the tide of wealth and fashion flowed steadily southward, making of that thoroughfare the distinctive residence street of the city. In the Nineties it reached its zenith, for it was lined on both sides with the imposing residences of men who, building wisely and well on the foundations laid by the preceding generation, were making of Chicago a city of splendor. At 2838 lived Harlow N. Higginbotham, through whose courage and inspiration a dream city was brought to reality in Jackson Park. At 1826 lived Ferdinand W. Peck, the second of a family line which dates from the very beginnings of Chicago. He was chairman of the finance committee of the World's Fair, president of the Chicago Opera Festival Association, and builder of the Auditorium. The list could be extended indefinitely, but just a few names will be added to give a better idea of this fine old street. Roswell Miller at 2959; Michael Cudahy, 3138; Charles T. Yerkes, 3201; P. D. Armour, Jr., 2735; John Cudahy, 3254; Conrad Seipp, 3300; George A. McKinlock, 3329; F. Kimball, 3341; A. A. Libby, 3357; Emanuel Mandel, 3400; Edward B. Butler, 3408; F. W. Straus, 3440; J. O. Armour, 3724; Edward Morris, 4500.

Nowhere in Chicago was the "mauve decade" more colorful than on Michigan Avenue, especially on those rare days when the sport of kings reached its apotheosis in the American Derby at Washington Park. No motor parade of today could approach in pageantry and public interest the splendid cavalcade which, to the accompaniment of drumming hoof and winding horn, made its way down Michigan Avenue. Here were to be seen Potter Palmer, W. W. Kimball, Arthur Caton, Hall McCormick, and a few others, who with no mean horsemanship piloted their "drags" down the crowded avenue. There were very few of these splendid private coaches, but many tandem carts, dog carts, tilburys, gigs, stanhopes, and victorias. Men and women in holiday attire crowded every vehicle, and when they were grouped on the lawn opposite the grandstand in Washington Park, they presented a colorful and animated scene, now gone forever with the passing of the horse.

Early in the present century, Michigan Avenue and adjacent streets began to decline and by the end of the first decade they plunged with tropic suddenness from sunlight into shadow. Before the steady pressure of expanding industrialism and the stealthy approach of an ethnic hybrid, the old residents slipped quietly away. On Prairie Avenue, the captains of industry and the kings of finance are now gone, and the locality, standing aside from the turbulent stream of the city's life, is but a backwash, filled with its inevitable jettison. Many of the fine old homes are gone, while in many another is found that relentless pursuer of retreating aristocracy, the boarding-house. On the porch of one of them an old man, dozing in the October sunshine, seems typical of the neighborhood. Wrapped in a mantle of memories, it too slumbers on, dreaming of its departed glories.

On Michigan Avenue, as far south as Twenty-sixth Street, the old homes have been displaced by the business houses of Motor Row. Farther out many of the brown stone fronts still remain, vacant or occupied by business. Everywhere one sees the ubiquitous boarding-house, the rooming-house with "Rooms to Rent," or the garish tea room with reputation slightly adumbrated. Occasionally there appears that curious anomaly in commercial nomenclature, the "funeral home." Here on stately staircase or in high paneled ballroom the ghosts of a commonplace present mingle with the shades of a splendid past. In the street, especially after dark when the business people of the district are gone the sidewalks are practically deserted. One rarely walks the street by choice, and if from necessity he journeys there, then "speeds the 'lated traveler apace," for in the heavier shadows on some intersecting street, east or west from the avenue, he may discern the lurking forms of the underworld, motley children of the night, lying in wait for the unwary.

In the street, by night or by day, the whole world seems awheel. The avenue is, and probably for a long time will continue to be, the great aorta of the city's automobile traffic. There is much to remember in a colorful and distinctive past, but the street neither sleeps nor dreams; pressing in upon it at all times like a physical weight there is the roar and reek of rushing motors. It now seems inevitable that business must claim the Boul. Mich. and the immediate milieu for its own, at least as far south as Thirty-ninth Street.

Such is the story of the South Side of which we as an institution have been a part for so many years. It is incomplete, no doubt, just a fleeting and imperfect retrospect, but presenting withal some of its high lights and low. Not as one who takes a picture, all in a single flash, has the writer tried to relate the story, but rather as one who weaves a fabric, bit by bit. Long vistas of yesterdays, some bright, some dark, make up the warp, and if our own part in it seems at times to have fallen short of our hopes, let us, facing the future, resolve to weave into it a shining woof of rare tomorrows.

## ARMOUR TECH ATHELETIC ASSOCIATION

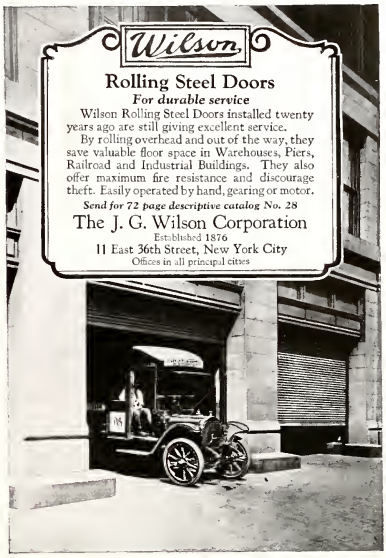
### Treasurer's Report, College Year 1925-1926

**Receipts**

| | | | |
|---|---|---|---|
| Cash Balance, September, 1925 | | | $ 2,868.01 |
| 744 student fees, $8.50 each, 1st Semester | | $ 6,324.00 | |
| Less class dues | | 744.00 | |
| | | | 5,580.00 |
| Less refunds (5 students did not attend classes, and 1 duplicate) | | 50.00 | |
| | | | 5,530.00 |
| 701 student fees, $8.50 each, 2d Semester | | 5,958.50 | |
| Less class dues | | 701.00 | |
| | | | 5,257.50 |
| Interest on bank balance | | | 156.26 |
| | | | $13,811.77 |

**Disbursements**

| | | | |
|---|---|---|---|
| Armour Engineer | $2,759.98 | | |
| Advertisements, Alumni and Faculty Subscriptions | 1,911.56 | | |
| | | 848.42 | |
| Baseball | | 34.40 | |
| Basketball | | 336.51 | |
| Boxing and Wrestling | | 115.14 | |
| Cycle | 3,848.15 | | |
| Advertisements, class and other donations, and sale of books | 1,502.63 | | |
| | | 2,345.52 | |
| Directors and Coaches | | 4,598.50 | |
| General Expenses | | 244.62 | |
| Golf | | 327.10 | |
| Musical Clubs | 419.59 | | |
| Concerts, including Home Concert | 136.75 | | |
| | | 282.84 | |
| Swimming | | 128.89 | |
| Tennis | | 409.89 | |
| Track | | 956.02 | |
| | | $10,627.85 | |
| Cash Balance | 3,855.42 | | |
| Less Class Balances | 671.50 | 3,183.92 | |
| | | | $13,811.77 |


Tech Pharmacy

Southwest Cor. 33rd and State Sts.

*College Supplies*

*Stationery*

*Sporting Goods*

*Eastman Kodaks and Films*

*Fresh Bulk Candies*

*Ice Cream—Sundaes—Sodas*

*Tobacco Cigars Cigarettes*

MAGIE BROTHERS

MANUFACTURERS OF

LUBRICATING OILS

AUTOMOBILE OILS

CUTTING COMPOUNDS

GREASE, COTTON WASTE AND BOILER COMPOUND

2135-37 So. Loomis Street, Chicago

Telephones: Canal 7125-7126

## CHEMISTRY AND THE PETROLEUM INDUSTRY

(Continued from page 10)

secondary and tertiary alcohols which are not readily obtained from other sources.

A significant example of how chemistry aids the refiner is found in the recent achievement of the Standard Oil Company of New Jersey, and the Empire Refineries, Inc. They have devised a process for converting unsaturated hydrocarbon gases from the cracking stills, formerly used as fuel to heat the stills, into isopropyl, amyl, and some of the higher alcohols.

At the American Chemical Society meeting in April, 1925, Dr. C. H. Herty, one of the leading American chemists, emphasized the importance of the chemist in developing these new processes. He believes, and he is not alone in his opinion, that the chemistry of the methane, ethylene, and acetylene series should be expanded, for large quantities of these substances will soon be available from petroleum at a low cost.

There is also more than a remote possibility that rubber will be made on a large scale from petroleum. Already it has been made experimentally from polymerized diolefins, such as butadiene and isoprene, a form of which is the gum that occasionally interferes with the operation of cracking stills and carbureters using cracked gasolines. The main drawback in the synthesis of artificial rubber has been a cheap source of butadiene. Petroleum is a potential source. The synthetic rubber obtained is comparable in every respect with the natural product; cost presents the only difficulty.

The preparation of true drying oils from petroleum is another problem in which intelligent research should bring results. Considerable attention has already been given to it. The drying oils are characterized by double bonds that absorb oxygen during the drying period, with the formation of a firm, elastic film. A method of making these double bond compounds will involve a considerable knowledge of organic synthesis. By suitable chlorination and treatment, a drying oil that compares favorably with linseed oil can be prepared from petroleum. According to several German patents, chlorination is also one of the main features in a process of making synthetic resins that are cheaper than the phenol-formaldehyde plastics.

Perhaps the most difficult task that confronts the chemist is the large scale production of fatty acids, ketones, and aldehydes from the higher petroleum hydrocarbons. The acids will be useful in the manufacture of soap and work has progressed far enough in this direction for Dr. Norris to predict that this source will provide the soap for several future generations.

The production of dyes from petroleum is yet an open field for research, but Frasch has succeeded in preparing several dyes of a different nature than the aromatic dyestuffs. Frasch, as long ago as 1893, took out several patents dealing with the production of a brown and a yellow dye from petroleum. By the nitration of the higher fractions of a Galician petroleum, a brown substantive dye can be prepared by the action of an alkali, while with sulfur and alkali, a brown-violet dyestuff results. So that the production of dyestuffs from petroleum is not so imaginary as it may appear at first.

Ordinary petroleum does not possess any particularly health-giving properties. But by retorting shales, distillates rich in sulfur are obtained which, when sulfonated and prepared in the form of the water-soluble ammonium salts, go by the name of ichthyol. This has marked medicinal properties and is used on skin sores, the same use that Marco Polo saw the crude Baku petroleum put to on his travels to Far Cathay, where it was the custom to smear the oil on the sore backs of camels. Other derived medicines will undoubtedly be developed.

In the production and refining of petroleum, considerable material is lost through the formation of emulsions. The breaking up or prevention of these emulsions is a problem for the colloid chemist, and is no easy one. The annual loss due to these emulsions has been conservatively estimated at well over a million barrels. Substances are now used which help to break up the emulsion. Some solid mixtures, consisting for the most part of sodium oleate, have been used with some success, a one per cent water solution being the most effective. A liquid compound, the sodium salt of sulfonated oleic acid, was developed after many experiments and is widely used. The one serious objection to these substances is that they require water as a solvent. Oil-soluble compounds of similar properties would obviously be more advantageous and the search for such a substance is now under way.

Production and refining losses involve a fair portion of the total production, so that chemical studies as to how these losses may be reduced to a minimum are not out of place. When gasoline is stored for any length of time in storage tanks, losses due to evaporation and breathing assume large proportions. In 1922, according to Wiggins, the loss by evaporation, from the well through the refinery, amounted to about $250,000,000. This would just about pay for all the Fords produced during that year. The research department of the Standard Oil Company of Indiana has recently been experimenting on specially constructed balloons, made of gasoline-impervious cloth, which catch the expanding vapors and prevent their escape into the air. The cloth used in their construction was evolved after considerable research. A fabric impregnated with gelatin, glycerine, and water was found satisfactory. The first few installed proved so successful that during the summer of 1925, over sixty more were put into use.

It is recognized that the greatest need of those engaged in the industry today is a standardization of testing methods, which includes both the procedures and the technic. Already considerable revision has occurred in the analytical methods applied to petroleum, but more work will be necessary before precise and detailed operations of general applicability are worked out. Even now some confusion exists in the industry, due to the wide variety of "standard" tests, samples which are acceptable by one method are rejected on the results of another. The American Chemical Society has had for several years committees, composed of representative petroleum chemists and others in direct contact with the industry, working on these problems and existing methods have been made the subject of critical study. As a result of this work many new standards have been adopted.

Oxidation products, produced by the catalytic oxidation of gaseous fuel oils at low temperatures, offer a broad range of possible commercial applications. It appears from the work of James and others that a whole series of novel oxidation products, with many uses, result when proper temperatures and catalysts are used. In this connection, the metals of high atomic weight, such as uranium and molybdenum, appear to yield the best results, while temperatures ranging from 300° to 500°C., preferably in the neighborhood of 400°, are best suited to promote the reaction. The products vary, of course, with the conditions, but in general they represent all the stages of oxidized aliphatic compounds, from alcohols and aldehydes to oxygenated acids. The higher fatty acids obtained in this way, when saponified with a caustic alkali give soaps, but when the liberation of the free acid is attempted by treating the soap with a mineral acid, hard resin-like substances appear that may prove useful as cheap varnish gum and paint film substitutes. When weaker bases, such as calcium hydroxide are used, good soaps are obtained, and by proper precaution, unresinified substances are secured. The

(Continued on page 34)

# Refrigeration Engineers Prefer *Armour's* *Anhydrous Ammonia*

ARMOUR'S Anhydrous Ammonia is made from aqua-ammonia, a by-product of the coking industry, and is guaranteed to be absolutely pure, dry and volatile—absolutely free from foreign substances. It is economical because its purity assures the removal of all possible heat units at a minimum operating expense. Every cylinder is tested before shipment, and is shipped subject to your evaporation test before using.

For these reasons, leading authorities have held Armour's Anhydrous Ammonia to be the most efficient as well as the most practical medium for refrigeration purposes.

Skill, long experience and superior equipment combine to give it a quality that is not excelled. Fifty pound, one hundred, and one hundred and fifty pound cylinders are carried in stock at all principal shipping points.

*Write for Full Particulars*

ARMOUR AMMONIA WORKS

*Owned and Operated By*

**ARMOUR AND COMPANY**

CHICAGO

## SUMMER CAMP

(Continued from page 11)

theodolites, plane tables, solars, military sketch boards, and hand levels. Naturally, quite a bit of the forty-four hours was spent in arguing the ways and means of doing things, for it seemed that all of the students knew better than anyone else, just what to do. Among other things, the Freshmen learned that it would not do to eat raisins before going near the transit, as it would affect the magnetic bearing.

The party consisting of Bob Fry, Christianson, Freedman, and Kara showed some ingenuity when, in running a continuous straight line, they were required to cut down a tree, contrary to instructions from the faculty. Just as the tree was cut down, Professor Wells strolled upon the scene. In an instant, a hole was dug and the tree set in and the ground banked around it. After Professor Wells' departure, a slight wind blew the tree down—the tree still lies there.

On July 16, we were honored by the presence of Mr. Wilson, the chief forest ranger of the Wisconsin Extension University, at supper. After supper he gave us an interesting talk on the subject of trees, including a short discussion of that *Woodman spare that tree* complex.

We all regretted that Professor Philips was not able to occupy his summer cottage which is situated a short distance from camp.

The fever to go home became quite general during the last week as the students prepared for their homeward journey. But when *Der Tag* finally did come it was a feeling of sincere regret that we left the old campsite, the lake, the wooded paths, and the land of a thousand and one sunsets—and mosquitoes.

## CHEMISTRY AND THE PETROLEUM INDUSTRY

(Continued from page 32)

portion comprised of unsaponifiable compounds is, according to James, a logical source of good lubricants. Other products will result when the study is extended; as for the present the production of such substances has hardly yet reached even the semi-industrial stage.

From a theoretical viewpoint, the utilization of petroleum as a source of valuable by-products and chemical raw materials is not limited to soaps, dyes, paint, and varnish bases, solvents, medicines, or even rubber. Enough nitrogen compounds are present, with traces of sulfur, to form the materials from which future chemists may make proteins and other foods. But this paper has attempted to limit these fanciful flights to more or less material products whose existence and production have already been demonstrated on a laboratory scale. Those topics which have been briefly discussed in this paper by no means exhaust the possibilities. There are numerous other problems in which the chemist is playing an important role. At the present, the greatest need seems to be research dealing with the mechanism of basic reactions. Fortunately, the oil industry as a whole has come to realize this; it can almost be said that a new spirit permeates the industry—a spirit that demands a thorough study of the fundamentals upon which oil refining is based.

With respect to the chemistry of petroleum, it may be remarked that the possibilities are unlimited. Many industrial as well as university research laboratories are now studying the reactions formerly characterized in chemical treatises as insignificant with the expectation that these reactions will lead to results of industrial value. Statements made ten years ago—that paraffins enter into no chemical reactions—are gradually being modified, not because their small reactivity has increased any, but because it is now regarded as being significant of future possibilities.

The day of empirical methods is past, and with the introduction of rigorous scientific principles, it is not difficult to visualize a growth that will even surpass that of the last decade. For the nourishment of this growth it is essential that there be an increment in research; then will the petroleum industry reap the benefits of what Huxley has termed, "the swift acceleration of scientific research."

## ILLINOIS CENTRAL ELECTRIFICATION

(Continued from page 16)

Two pantographs are mounted on the motor car, but only one at a time is used, ordinarily. The total number of cars starting electric operation is 260.

The electrified service has been found to be far superior to the steam service in many respects. The increased schedule speeds, more frequent trains, more comfortable riding, the elimination of smoke, and the greatly increased real estate values are the chief advantages to the public. More flexible operation, less winter operating troubles, reduction in operating costs, increase in value of real estate, better public relations, and valuable advertising are the benefits to the railroad company.

Since the electrification of the Illinois Central Chicago Terminal is only one part of a program of improvement involving other projects costing much more than electrification, something should be said of these other works because of their correlation with electrification.

The rearranging of tracks in the terminal, with accompanying elimination of grade crossings, had to be completed before electrification. Track levels had to be radically changed to allow for the construction of the South Park Commission's viaducts across the right-of-way north of Fifty-first Street and to provide for separation of grades at various locations. The position of the suburban tracks with respect to the freight and through passenger tracks was considerably changed, making it necessary to rebuild or move many suburban station buildings. Also, space had to be provided for the catenary supporting structures.

Markham Yard, the largest freight yard owned by a single railroad company, was built at a distance of 22 miles from the Randolph Street terminal. This great yard will not only relieve the downtown yards of the railroad company and make a wonderfully efficient freight terminal, but will provide for a transfer point where, eventually, all through trains will change from steam to electric locomotives on entering the Chicago terminal. The yard itself is five miles long and over a mile wide. It is of the most modern design and contains electric and electro-pneumatic car retarders for controlling the cars being distributed from the humps. A very well-equipped shop for repairing locomotives, as well as a large roundhouse with attendant facilities for coaling, watering, and inspecting locomotives, is at the south end of the yard.

A large passenger station for through trains is planned. It will be located near Michigan Avenue and Roosevelt Road. The detailed design has not been completed because of the unsettled plans of the railroads which may use the Illinois Central Station as tenants. The station will provide for electric operation of trains.

A new large suburban terminal passenger station is now under construction at Randolph Street near Michigan Avenue. This station will be complete in every respect and of sufficient capacity to handle more than the present 413 trains a day.

## Where dependability is vital

IN connection with a new pumping station at Milwaukee, Wisconsin, additional feeder mains were required. It was necessary that one of these should carry an unusually large proportion of the water supply, and 54-inch pipe was decided upon. Although pipe of material other than cast iron had a lower first cost, Cast Iron Pipe was chosen because the possibility of interruption to service had to be reduced to a minimum.

The photograph above shows a section of pipe being lowered into the ditch in the process of laying it.

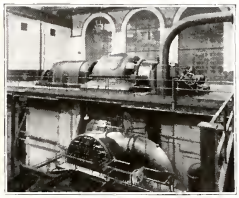
THE CAST IRON PIPE PUBLICITY BUREAU
Peoples Gas Bldg., Chicago

# CAST IRON PIPE

*Our new booklet, "Planning a Waterworks System," which covers the problem of water for the small town, will be sent on request*

*Send for booklet, "Cast Iron Pipe for Industrial Service," showing interesting installations to meet special problems*





## *Power Generating and Distribution Equipment*

Prime movers of all types, Steam Turbines, Steam Engines, Hydraulic Turbines, Gas and Oil Engines, together with a full line of generators for each type.

Auxiliary equipment, consisting of Transformers, Motor-generator sets, Converters, Switchboards, etc.

Motors, both Direct and Alternating Current, for every kind of application.

A complete line of high-grade Transmission Machinery; Pulleys, Shafting, Hangers, Couplings, etc.

ALLIS-CHALMERS MANUFACTURING CO.
MILWAUKEE, WIS. U.S.A.



# LALLY COLUMNS

*are*

Steel-Shell, Concrete-Filled Building Columns

*with*

Steel Caps and Bases

*Dependable —Economical*

Have Given Satisfaction for 29 Years

*Prompt Shipment*

LALLY COLUMN CO.,
OF CHICAGO
4001 Wentworth Ave.,
CHICAGO, ILL.

Boulevard 5871-72

·LALLY COLUMN·
·Stack Construction·

**WIRE** automobile and airplane wires, electrical wires, submarine cables, bridge-building cables, wire rope, telegraph and telephone wire, radio wire, round wire, flat wire, star-shaped and all different kinds of shapes of wire, sheet wire, piano wire, pipe organ wire, wire hoops, barbed wire, woven wire fences, wire gates, wire fence posts, trolley wire and rail bonds, poultry netting, wire springs, concrete reinforcing wire mesh, nails, staples, tacks, spikes, bale ties, steel wire strips, wire-rope aerial tramways. Illustrated story of how steel and wire is made, also illustrated books describing uses of all the above wires sent free.

**AMERICAN STEEL & WIRE COMPANY**

*Sales Offices*

Chicago New York Boston Cleveland Worcester Philadelphia Pittsburgh Buffalo Detroit Cincinnati Baltimore Wilkes-Barre St. Louis Kansas City St. Paul Oklahoma City Birmingham Memphis Dallas Atlanta Denver Salt Lake City

Export Representative: U. S. Steel Products Co., New York

Pacific Coast Representative: U. S. Steel Products Company, San Francisco, Los Angeles, Portland, Seattle

## SALVAGING OLD STONE ROAD SURFACES

Door and Kewaunee Counties, Wisconsin, have evolved a scheme for salvaging the old road surface and making a brand new one therefrom. This is accomplished by means of a portable crusher, and briefly the method is as follows: The old road surface is scarified and harrowed until all the large stones are pulled to the surface. They are then raked to the sides of the road. The portable crusher proceeds up one side of the road and down the other, crushing the material, which is immediately placed back on the road surface. According to Badger Highways, in this manner from 300 to 500 yards of new material is placed per mile at a cost of approximately $1.00 per yard. —*Road and Street News.*

## ENGINEERING NEWS

*(Continued from page 28)*

of glycerine and an equal number with a 35%, by volume of alcohol. These were then used under normal operating conditions and samples of the cooling liquids were analyzed periodically to see whether there was any loss of either glycerine or alcohol. Temperatures during the test ranged between 5 degrees below and 50 degrees above zero.

A loss of denatured alcohol of 35% by volume solution proved to be about 4/5 of a quart per 100 miles of driving.

A loss of distilled glycerine of 35% by volume solution was practically zero. About 1/100 of a gallon was lost per 100 miles due apparently to some of the liquid splashing up into the overflow tube. However, this small loss is negligible.

During the test only one car was frozen. This was one in which alcohol was being used and in which evaporation had reduced the strength of the solution to the danger point before enough additional alcohol had been added to restore the solution to its original strength. Only one car showed a tendency to develop leaks at the hose connection. This was a car with a glycerine-filled radiator. Tightening the clamp corrected the trouble at once.

*ALUMNI*

OF THE

ARMOUR INSTITUTE *of* TECHNOLOGY

ARE INVITED TO JOIN THE

COLLEGIATE CLUB *of* CHICAGO

*Over a half hundred Armour Men have already joined the Club*

(ASK THEM OR ANY ONE OF THE 1700 OTHER MEMBERS ABOUT IT.)

*Collegiate Club of Chicago*

*Executive Offices*

510 Portland Block 35 North Dearborn Street State 5836

• • CRANE VALVES • •

*Gate Valve*
**No. 488**

All-iron clamp gate valve, extensively used in oil and gas fields and plants and all classes of manufacturing plants.

## *What Crane owes its engineers*

Crane Co. is proud of the contribution of its engineers to their profession. Their tests, experiments and inventions have carried valves from a primitive state to a high degree of perfection, serving virtually every branch of engineering and industry. Their investigations into the reactions of metals under varied, exacting conditions have enabled Crane to be sure of valves and fittings uniform in tensile strength, insuring that Crane equipment will stand up under the tasks and conditions for which they are recommended. In the practice of your profession, we hope that you too will find cause to be grateful to Crane engineers for making possible such dependability.

# CRANE

*Address all inquiries to Crane Co., Chicago*

**GENERAL OFFICES: CRANE BUILDING, 836 S. MICHIGAN AVENUE, CHICAGO**

*Branches and Sales Offices in One Hundred and Fifty-five Cities*

*National Exhibit Rooms: Chicago, New York, Atlanta City, San Francisco and Montreal*

*Works: Chicago, Bridgeport, Birmingham, Chattanooga, Trenton, Montreal and St. Johns, Que.*

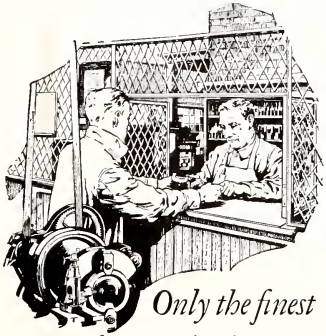
CRANE EXPORT CORPORATION: NEW YORK, SAN FRANCISCO, MEXICO CITY, HAVANA

CRANE LIMITED: CRANE BUILDING, 386 BEAVER HALL SQUARE, MONTREAL

CRANE-BENNETT, LTD., LONDON

CIE CRANE: PARIS, BRUSSELS





## *Only the finest* tools can win the good mechanic's confidence

IT takes a long time to win the good mechanic's confidence in tools. It takes a long record of dependability and hard, steady service to maintain their confidence after it is won. Brown & Sharpe Tools have held the confidence of good mechanics all over the world for more than three generations.

Many men have praised the fine finish and the balance or "feel" of Brown & Sharpe Tools. All will swear by their constant unerring accuracy. As a group, mechanical men find the complete line dependable,—handy tools for better and faster work.

Whatever branch of engineering work you choose, a knowledge of Brown & Sharpe Tools will be of value. A request will bring the No. 30 Small Tool Catalog which, in addition to listing 2300 tools and 1500 cutters, contains a liberal supply of tool information.

**BROWN & SHARPE MFG. CO.**
**PROVIDENCE, R. I., U. S. A.**

CHARLES W. HILLS CHARLES W. HILLS, Jr.

CHARLES W. HILLS

PATENT, TRADE MARK, COPYRIGHT
AND CORPORATION LAW

1523-38 MONADNOCK BUILDING
CHICAGO

*Cable Address Hillsford, Chicago* *Telephone, Harrison 6150*

# Armour Institute of Technology
## Chicago

## The College of Engineering Offers Courses in

ELECTRICAL ENGINEERING
MECHANICAL ENGINEERING
CIVIL ENGINEERING
FIRE PROTECTION ENGINEERING
CHEMICAL ENGINEERING
ARCHITECTURE

*These courses are each four years in length and lead to the degree of Bachelor of Science*

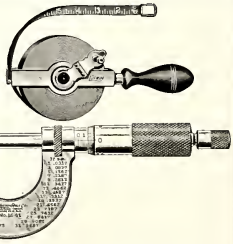
COMPLETELY EQUIPPED SHOPS AND LABORATORIES

## *The* Institute Bulletins
Will be Sent on Application

LUFKIN

TAPES, RULES, TOOLS
INSURE YOUR MEASUREMENTS
On Sale Everywhere
Send for Catalog

THE LUFKIN RULE CO.
Saginaw, Michigan
New York Windsor, Canada



*Please mention The Armour Engineer*

KEYSTONE COPPER STEEL

## Steel Sheets that Resist Rust!

The destructive enemy of sheet metal is *rust.* It is successfully combated by the use of protective coatings, or by scientific alloying to resist corrosion. Well made steel alloyed with Copper gives maximum endurance. Insist upon

# KEYSTONE
## Rust-Resisting Copper Steel
# Sheets

*Black and Galvanized*

Keystone Copper Steel gives superior service for roofing, siding, gutters, spouting, culverts, flumes, tanks, and all uses to which sheet metal is adapted—above or below the ground. Our booklet *Facts* tells you why. We manufacture American Bessemer, American Open Hearth, and Keystone Copper Steel Sheets and Tin Plates.

**Black Sheets for all purposes**
**Keystone Copper Steel Sheets**
**Apollo Best Bloom Galvanized Sheets**
**Apollo-Keystone Galvanized Sheets**
**Culvert, Flume, and Tank Stock**
**Corrugated Sheets**
**Formed Roofing and Siding Products**
**Automobile Sheets—all grades**
**Electrical Sheets, Special Sheets**
**Deep Drawing and Stamping Stock**
**Tin and Terne Plates, Black Plate, Etc.**

**Our Sheet and Tin Mill Products represent the highest standards of quality, and are particularly suited to the requirements of the mining, engineering, and general construction fields. Sold by leading metal merchants. Write nearest District Office.**

## American Sheet and Tin Plate Company

General Offices: Frick Building, Pittsburgh, Pa.

DISTRICT SALES OFFICES

Chicago Cincinnati Denver Detroit New Orleans New York
Philadelphia Pittsburgh St. Louis

Pacific Coast Representatives: UNITED STATES STEEL PRODUCTS CO., San Francisco
Los Angeles Portland Seattle

Export Representatives: UNITED STATES STEEL PRODUCTS CO., New York City

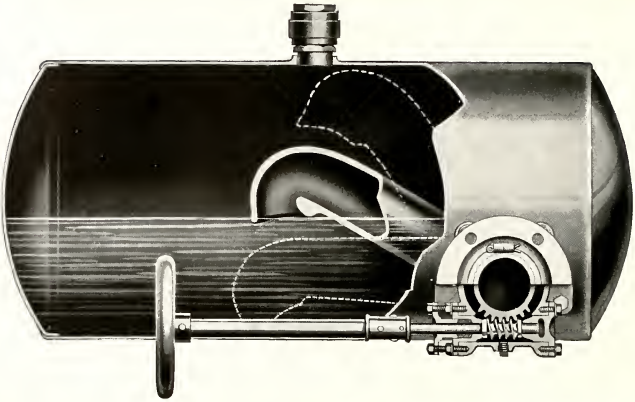
MISSISSIPPI - WIRE - GLASS - CO - FIRE RETARDANT No 32 - WG

RAILWAY EXCHANGE
ST. LOUIS
*Mauran, Russell & Crowell, Architects*

Every Window Above Ground Floor
Is Wire Glass

Permanence—Minimum Maintenance
Fire and Breakage Protection
were important factors
considered

**MISSISSIPPI WIRE GLASS CO.**
220 Fifth Avenue
*Chicago* New York *St. Louis*



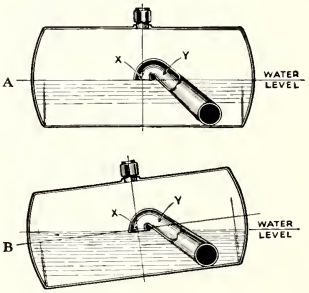
# —*another reason* why Koehring Pavers Produce Dominant Strength Concrete

VITALLY important to the resultant strength and durability of concrete is the admittance of an accurate amount of water into the mixing drum at exactly the right instant. Long ago the Koehring Company recognized this fundamental requirement and set to work to devise an automatic water measuring system.

Today, the system is as nearly exact and accurate as human ingenuity has been able to design. A balanced three-way valve is automatically opened at a certain point, by the charging skip as it is raised, admitting the water into the mixing drum at exactly the right instant. The regulating hand wheel governs to a minute accuracy the amount of water which is to be used per batch.

All dribble is eliminated by the syphon-gravity principle which draws the water through a straight 3½ inch pipe into the mixing drum. Straight flow from the tank to drum secures a fast, clean discharge.

This is another pioneering development by Koehring engineers which with the Koehring batch meter, Koehring boom and bucket, and Koehring five action re-mixing principle produces standardized, dominant strength concrete of unvarying uniformity.




A and B illustrate clearly why changes of grade do not materially affect the accuracy of water measuring when using the Koehring system. X represents the volumetric center of the tank and Y the measuring arm.

*"Concrete—Its Manufacture and Use" is a 210 page treatise on the uses of concrete, including 26 pages of tables of quantities of materials required in concrete paving work. To engineering students, faculty members and others interested we shall gladly send a copy on request.*

KOEHRING COMPANY
MILWAUKEE WISCONSIN

MANUFACTURERS OF PAVERS, MIXERS—GASOLINE SHOVELS, CRANES AND DRAGLINES

*Please mention The Armour Engineer*

# *Broadcasting from* CRH

C. R. Hanna

"NEVER heard of station CRH", you'll say. Quite naturally, for CRH is not a station. CRH is Clinton R. Hanna, age 27, out of Purdue less than five years, a Research Engineer with Westinghouse at East Pittsburgh.

Any time you're listening to your radio, however, you may be getting better reception, a clearer program, because of CRH and the improvements in reproducing apparatus to which he contributed.

That story goes back to undergraduate days at Lafayette. Hanna, as a student, developed an intense interest in radio; and, making capital out of his hobby, his thesis was entitled, "Interrupter Type of Radio Transmitter."

To carry on his experiments, it was logical that Hanna should find his way into the Westinghouse Graduate Students' Course immediately after graduation. There he received varied practical shop training. Then, in less than a year, he was busily at work on his favored radio subject at the Westinghouse Research Laboratories.

One of his accomplishments has been the development of an improved microphone. He has introduced the electrodynamic principle, in place of the condenser-transmitter type of microphone in earlier use. Hanna's development assures good quality of speech and music with greater continuity of operation than other types, because of its ruggedness and sensitivity.

For this inventive spirit and its result in microphones, Hanna's alma mater in 1926 honored him with a degree of Electrical Engineer to go with his Bachelor of Science degree of four years earlier.

And these are studies which still go on. There is no end to progress. It is because Westinghouse offers both facilities and appreciation for practical study that Research Engineers find satisfying careers in the Company's laboratories.

*"What's the future with a large organization?" That is what college men want to know, first of all. The question is best answered by the accomplishments of others with similar training and like opportunities. This is one of a series of advertisements portraying the progress at Westinghouse of typical college graduates, off the campus some five—eight—ten years.*

**Westinghouse**

WESTINGHOUSE ELECTRIC

# At Forty

"At Forty" the housewife in some sections of Europe wears a black bonnet to signify the end of her youth. A quaint custom—you say—but it usually signifies a fact. Heavy tasks, indoors and out, have made her old—at forty.

Of all the uses of electricity in America, the most important are those which release the woman from physical drudgery. Electricity carries water, washes clothes, cleans carpets, cooks the family's food—better and quicker than could be done by hand.

A trip to town or an hour's rest in the afternoon pays a woman dividends in good health "at forty years." And what is *youth* but that?

Men and women who have had the benefit of college training and college life have learned to place the proper value upon rest and recreation. They appreciate the relief afforded by electricity.

Upon great generators which send out current to light the homes and carry the burdens of millions, you will find the G-E monogram. Upon industrial motors, on electric railway trains—wherever quality and unfailing performance are first essentials—the G-E monogram will be found.

A series of G-E advertisements showing what electricity is doing in many fields will be sent on request. Ask for booklet GEK-1.

95-250DH

GENERAL ELECTRIC

GENERAL ELECTRIC COMPANY, SCHENECTADY, NEW YORK

# The ARMOUR ENGINEER

VOL. XVIII JANUARY, 1927 NO. 2

*Published Quarterly by the College of Engineering*
*Armour Institute of Technology*
*Chicago, Ill.*

*Member of Engineering College Magazines Associated*

# Koehring Re-mixed Concrete

## *is Dominant Strength concrete*

IN addition to the use of proper aggregates, positive control of the thoroughness of mix and the correct amount of water accurately timed, there is finally, an essentially important factor in the production of standardized concrete of Dominant Strength. It is the proper mixing action.

The raw materials—cement, sand, stone and water—must be so combined and mixed that the resultant concrete will be of maximum strength and quality. The drum of the Koehring concrete mixer has been designed to produce a re-mixing action which coats every particle of aggregate thoroughly with cement. Tests have proved that the Koehring five action re-mixing principle accomplishes this most completely.

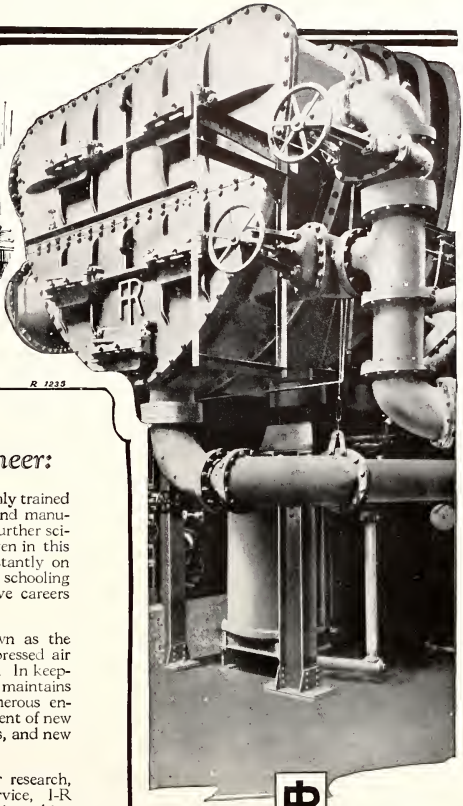
Koehring supremacy inside the drum goes even further. With the Koehring re-mixing action there is no separation of aggregate according to size—it is uniform to the last shovelful of every batch.

*"Concrete—Its Manufacture and Use" is a 210 page treatise on the uses of concrete, including 26 pages of tables of quantities of materials required in concrete paving work. To engineering students, faculty members and others interested we shall gladly send a copy on request.*

(1) Blade cuts through materials with churning action. (2) Blade carries materials up, spilling down again against motion of drum. (3) Materials hurled across diameter of drum. (4) Materials elevated to drum top and cascaded down to reversed discharge chute which (5) with scattering, spraying action, showers materials back to charging side for repeated trips through mixing process.

**KOEHRING COMPANY**
**MILWAUKEE WISCONSIN**

*Manufacturers of* **Pavers, Mixers—Gasoline Shovels, Cranes and Draglines**



## *To the Future Engineer:*

Every progressive industry needs highly trained engineers who can conceive, design, and manufacture its products. Realizing that further scientific developments are inevitable, even in this age, Ingersoll-Rand Company is constantly on the lookout for young engineers whose schooling and training have fitted them for active careers in the technical field.

Ingersoll-Rand has long been known as the world's leading manufacturer of compressed air machinery and power plant equipment. In keeping with this position, the Company maintains seven manufacturing plants and numerous engineering laboratories for the development of new compounds, new devices, new machines, and new methods.

No matter what the field—whether research, development, manufacturing, or service, I-R engineers are playing a prominent role in making each installation an important engineering achievement and a source of satisfaction to its owner.

**Ingersoll-Rand Company**

**11 Broadway** **New York City**

*Offices in principal cities the world over*

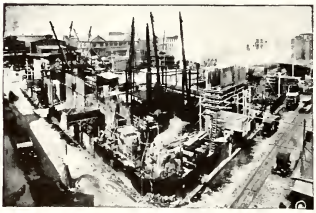
An Ingersoll-Rand Surface Condenser of the type used in many of the country's largest power plants.

This style of condenser, a development pioneered by Ingersoll-Rand Company, has practically revolutionized central station practice, as it utilizes only about half the surface considered necessary in condensers of the older designs.

# Ingersoll-Rand

*Please mention The Armour Engineer*

# "From Turret to Foundation Stone"



Complete design and construction of all types of structures are included in the service offered by The Foundation Company. Efficient production in industry is dependent upon scientific design of plant;—and initial cost of plant is dependent upon economical, rapid and skillful construction.

Modern factory buildings must contain every facility to meet the demand for effective mechanical operation, and for consideration of the human operator. The mill built for Courtaulds, Limited, at Cornwall, Canada, s ia model of such factory construction.

The construction of the locomotive erecting shops of the Southern Railway at Atlanta, Georgia, is a notable example of complete service rendered by engineering contractor, working in full cooperation, in both design and construction, with the engineers of the railway company.

Often considerations of location determine a site where construction of the foundations is rendered unusually difficult. The New York Telephone Building, of which Marc Eidlitz & Son, Inc. were General Contractors, was placed where the Hudson River used to flow; yet modern methods permitted The Foundation Company to construct the substructure reaching to rock five stories below surface level.

These are but a few of the types of projects constructed by this organization.

## THE FOUNDATION COMPANY

### CITY OF NEW YORK

*Office Buildings · Industrial Plants · Warehouses · Railroads and Terminals · Foundations*
*Underpinning · Filtration and Sewage Plants · Hydro-Electric Developments · Power Houses*
*Highways · River and Harbor Developments · Bridges and Bridge Piers · Mine Shafts and Tunnels*

ATLANTA
PITTSBURGH
CHICAGO

SAN FRANCISCO
LOS ANGELES
MONTREAL, CANADA

MEXICO CITY
LIMA, PERU
CARTAGENA, COLOMBIA

LONDON, ENGLAND
BRUSSELS, BELGIUM
TOKYO, JAPAN

BUILDERS OF SUPERSTRUCTURES AS WELL AS SUBSTRUCTURES

# THE ARMOUR ENGINEER

*Published Quarterly by the College of Engineering*

ARMOUR INSTITUTE OF TECHNOLOGY

Volume XVIII January, 1927 No. 2


## Table of Contents


Cover Design, a Drawing of the Largest Steam Passenger Locomotive in the World, by John William Urban, '27. (A description of this and other great locomotives appears in the Engineering News Section.)

The Art of Color Reproduction by Process Plates ..... 45
D. A. Patterson.

Pine Oil ..... 48
John L. Burda, '17.

High Grade Malleable Iron ..... 50
George B. Stantial, '23.

Manufacture of Concrete Bricks ..... 53
Lester E. Grube, '24.

What Price Knock ..... 54
Daniel Roesch, '04.

One of the Great Religions of the World ..... 56
Walter J. Zenner, '28.

The Construction of a Chicago Water Tunnel ..... 57
Wm. E. Downes, '26.

The Armour Alumnus ..... 59

The Unofficial Observer ..... 60
J. C. Peebles, '04.



Published in November, January, March, and May by the College of Engineering, Armour Institute of Technology. Publication office: 3300 Federal Street, Chicago, Illinois. Subscription price, $1.50 per year, postage prepaid. Single copies, fifty cents.



ENGINEERING COLLEGE MAGAZINES ASSOCIATED

*Chairman:* Professor Leslie F. Van Hagan, Madison, Wisconsin.

Armour Engineer
Colorado Engineer
Cornell Civil Engineer
Illinois Technograph
Iowa Engineer
Iowa Transit
Kansas Engineer
Kansas State Engineer
Michigan Technic
Minnesota Techno-Log
Nebraska Blue Print
Ohio State Engineer
Penn State Engineer
Pennsylvania Triangle
Princeton News-Letter
Purdue Engineering Review
Rose Technic
Sibley Journal of Engineering
Tech Engineering News
University of Virginia Journal of Engineering
Wisconsin Engineer

**We urge our readers to take advantage of the technical information that our advertisers will gladly furnish upon request**


COPYRIGHT, 1927, BY THE ARMOUR ENGINEER

昇
降
機
Лифт
Ascenseur
Ascensor
Ascensore
Aufzug
Elevador
Lift
Elevator
OTIS

The above are reproductions of the Japanese, Russian, French, Spanish, Italian, German, Portuguese, English, American and universal equivalents for elevators.

*On sea or on land, at home or abroad, the single word OTIS is sufficient.*

Otis
THE WORLD'S WORD FOR ELEVATOR SAFETY

OTIS ELEVATOR COMPANY
Offices in all Principal Cities of the World

*The*
# ARMOUR ENGINEER

VOLUME XVIII | JANUARY, 1927 | NUMBER 2

# THE ART OF COLOR REPRODUCTION THROUGH PROCESS PLATES

**By D. A. PATTERSON**

***General Manager, Rosenow Company, Printers and Engravers***

COLOR is an expression of human emotion. Its appeal is as universal and inherent in life as laughter and tears. Indeed, it might be truly said that color *is* life, for without it our existence would be as drab and monotonous as life on the cold, dead moon.

On the other hand, is it possible for one to picture life without the sun? Scientists maintain that we would die without its warmth; but, aside from its thermal qualities, the sun is a gigantic expression of color. And it *is* our life.

Nature paints everything in color—the flowers, the trees, the earth, the sea; everything with which we are familiar has its color. And just for that reason, our every act and emotion can be expressed through that medium. Some colors stimulate, others depress. Red signifies heat, passion, and danger. Blue is cool and soothing. Yellow and orange are gay, warm, and luminous. Green is stimulating; and so on. To paraphrase a popular song: every little color has a meaning all its own.

We are susceptible to the influence of color from the cradle to the grave. The baby coos with delight at the red rattle. The child pores over colored picture books long before it learns to read. The schoolboy and girl lean to vivid colors in dress. Even adults turn first to the colored comic supplements of the newspapers. And why colored uniforms for soldiers in the olden days? The red coat stimulated its wearer to deeds of valor. Today, however, soldiers wear uniforms to harmonize with the open country. Color stimulation has given way to color expediency. But it cannot be gainsaid that color serves a good and useful purpose in every phase of our lives. On the other hand, color wrongly employed can be decidedly harmful.

D. A. Patterson

The extent to which people of every age and condition of temperament react emotionally to the driving force of color wrongly employed is borne out by the recent declaration of a well-known interior decorator. He was asked just how a person of the "sensitive" type, like a writer, a painter, or a lawyer, could be driven to positive insanity by playing on his nerves in the *right* way with the *wrong* colors. He answered:

"I would put him to work in a small study. I would paint the walls a very warm red in some very intricate design. Gradually, this bright red and intricate design would irritate, and the walls would seem to be crowding in on him constantly. I will not guarantee that he will end in the madhouse, but I'll guarantee that he'd rather go to the madhouse than stay in that room."*

Another instance: Three stenographers worked in an office through two winters without once complaining of the temperature. The walls were done in warm yellow.

One summer these walls were repainted in a dull slate-blue. Soon after winter set in the girls complained of the cold. Frequently, they wore sweaters and overcoats at their work.

The thermometer records of this office for the two preceding years were consulted. It was found the room had never been above 72°. The room was heated to 75°, but still the girls complained of "feeling chilly." Finally, the walls were redone in the warm yellow of the years before and the "coldness" disappeared immediately. The "coldness" of the slate-blue color on the walls was responsible.

Instances of this color stimulation could be expanded into a book, but it will be seen that color is a decidedly important factor in our mental and physical condition—a factor that touches every phase of our lives every day of our lives.

One phase that is becoming more and more dependent on color is modern printing, particularly advertising. Our most successful magazines — the Saturday Evening Post, Liberty, Cosmopolitan, Ladies' Home Journal, Pictorial Review, etc., are shot with the glow of color from cover to cover. The reason? Because color is the prime means of attracting and holding attention; and un-

*Quoted by Professor A. J. Snow, Ph.D., of Northwestern University, in a recent treatise on Color Psychology.

less an advertisement achieves just that, it is so much wasted effort.

Aside from its function of attracting attention, the appeal of color can be divided into several classes, to wit: novelty, distinctiveness, symbolism, innate appeal, usefulness, realism, etc. Advertisers and publishers have learned the unquestioned psychic effect of color. Therefore, they utilize it lavishly. And this use is increasing every day. Let us trace, briefly, the application of color to modern printing.

Printing, the art of transferring letters, characters, and designs to paper or other suitable surfaces by means of ink or greasy pigments, has three great divisions — letterpress, copperplate engraving, and lithography. These are the basic forms of printing upon which all other special methods depend.

Letterpress printing is the process most widely used and with which everyone is to some extent familiar. In letterpress printing the printing surface stands out in relief and alone receives the ink. It is the method used in most printing today —in newspapers, books, magazines, and direct mail advertising.

Copperplate engraving is the reverse of letterpress printing. In the former, the images or letters to be printed are cut into the surface of the plate. The entire plate is then inked and the ink removed from the smooth surface and left in the intaglio incisions cut into the plate. Then, when the sheet of paper is impressed against the plate, it picks up the ink from the engraved parts only, and the result is a raised lettering on the printing surface. Rotogravure, used in the supplements of some Sunday newspapers, is a form of this intaglio printing.

The third process is lithography from stones, on which a greasy ink has been spread. More recently the basic inking surface of a rubber blanket has been substituted and developed. The fundamental idea of lithography is to cause the inks to adhere only to those portions of the zinc printing plate that are to be impressed, and to be rejected entirely by the blank parts. This is done by chemical affinity. The portions of the plate to be printed are treated with chemicals that have an attraction for ink. The blank parts are saturated with water, that rejects the greasy pigment. The rubber blanket receives the impression of the inked part of the plate and, in turn, impresses that part directly onto the paper surface. This involves a double operation, thus: the plate is impressed onto the rubber blanket which, in turn, prints what it has received onto the printing surface.

Letterpress printing is by far the most universal method. It is direct—from plate to paper—and for that reason the most efficacious manner of transferring letters, characters, and designs to the printing surface. The art of color reproduction through process plates depends upon this commonsense method.

Although it is not the purpose of this article to compare the letterpress method of printing with other processes, it must be conceded that for true, faithful reproduction of color the letterpress method, by means of process plates, achieves the best possible result.

However, the latter statement might be qualified by saying that process plates achieve an equal or better effect of color reproduction than lithography by the use of only three (or at the most, four) colors; whereas lithography needs and uses from eight to twelve plates and eight to twelve kinds of ink to obtain anywhere near the same result. In other words, process plates, with less than half the paraphernalia and labor, achieve an equal or better color effect than lithography. But there are many other reasons why process plates, utilizing the letterpress method of printing, constitute the most effective and preferable system of reproducing color today.

Letterpress printing is the most *direct* method. It involves only one operation — from plate to paper. Offset printing (which is the most recent development of lithography) is an *indirect* method — the plate is impressed on the rubber blanket and the latter, in turn, transfers the impression to the paper.

Another reason is that, in process plate making, the etcher has unlimited latitude in his task of bringing out all the subtle nuances of color that appear in the original drawing. The photographer turns out a set of negatives as nearly perfect as is humanly and mechanically possible. But it is still necessary to re-etch and burnish the plates so as to tone down the darker portions and bring out the lighter areas that the colors may exactly match the artist's original. It is this human touch, this artistic subtlety, that adds so much to the mechanical processes and brings to

*Four color Process Plate, by Rosenow Company, Chicago*

The combination of colors in a process plate: A, yellow plate; B, red plate; C, black plate; D, blue plate; E, yellow and red plates in combination; F, yellow, red and black plates in combination; G, yellow, red, black and blue plates in combination—the complete process set of engravings.

a machined product the artistry that distinguishes a human from a mechanical work of art.

Color reproduction by means of process plates is the employment, in combination, of the three primary colors — yellow, red, and blue. A separate plate of each of these primary colors is made from the original subject; and these, in combination, achieve, when printed, an exact reproduction of the original.

As every painting, no matter how many colors it *appears* to have, is but a combination of the three primary colors, it is necessary to make only three separate plates; and to print these, one on top of the other, on the printing surface. It is the *combination* of these colors that faithfully reproduces the artist's drawing in all its entirety and with all its delicate color tones.

The method of making these plates is simplicity itself. The original subject is placed in front of the camera and focused to a predetermined size. In the lens of the camera is placed a purple filter (a combination of red and blue). This filter absorbs the yellow in the subject and allows the other colors to pass through the lens as white. Only the yellow is blocked by the filter, and that color appears as black on the negative when the picture is taken. The result is a photographic plate of the yellow areas of the subject only.

The same course is followed twice more—one for each other primary color. The reds in the painting, photographed through a green filter, appear on the negative as black. The blues appear black when photographed through an orange filter. Thus we have three black plates, each an exact reproduction of a primary color as it appears in the subject. When these plates are run separately through the printing press, each inked with its primary color, the total result is an exact ectype of the original subject in color. That, in brief, is the theory of process plate making. The actual accomplishment involves many other deatiled processes that are hardly necessary to enumerate and explain here.

In some instances, however, it is necessary to make a black plate in addition to the three primary color plates. This black plate is sometimes needed to act as a "toner" in the reproduction of subjects where the combination of the three primary colors is insufficient to obtain the exact effect of the artist's original. But black is not a primary color in itself. It is a combination of the three primary colors.

It will be readily understood that were a red color run over a yellow color and a blue superimposed on both, the result would be a pure black. Hence, to obviate that certainty, each photograph of a primary color is taken through a screen set at a different angle. This is done so the colors may be combined on the printing surface without friction.

All half-tone engravings are made by photographing the subject through a glass screen on which are etched cross lines set at right angles. This serves to cut the picture into minute squares, which form dots on the printing plates after they are made. Now, if each of the three (or four) color plates had these dots in exactly the same position on its surface, it is obvious that the printed combination of the three plates would be a solid black. Therefore, to cut this solidity of color to allow light to penetrate, each color on the subject is photographed through the same screen set at a different angle. When the yellows are photographed, the screen is set at a 90° angle, the reds with the screen at a 75° angle, the blues at a 105° angle, and the blacks at 45°. Thus, the dots on each of the color plates appear in slightly different positions — which nullifies the effect of one color being exactly superimposed on the other on the printing surface.

After the three (or four, if a black plate is made) negatives of the primary colors are completed, each of them is printed on a sheet of copper. This copper plate is sensitized with an enameled solution baked onto its surface that it may resist the acids that are utilized in the etching.

Following that process, the copper plates are turned over to the etcher. It is his task to accentuate all the delicate lights and shadows that lack strength, and to tone down those that are too strong, that the printed result may conform as closely as is humanly possible to the artist's original drawing. When the plates are properly etched and faithfully combined in the printing, they achieve a quality of artistry that is as near perfection as mechanical and human endeavor can make it.

It is true—for it has been proved repeatedly — that the proof of a set of properly executed process color plates can be placed side by side with the original from which they were made, and that one cannot be distinguished from the other without a magnifying glass. This millennium of color reproduction is only possible in process plates printed by means of the letterpress method. No other method of color reproduction, employing a similar amount of color and equipment, can possibly achieve a result that so closely matches the concept of the original artist. Color reproduction by way of process plates is truly the perfection of mechanical work and human ingenuity.

*Four-color Process Plate, by Rosenow Company, Chicago*

THE COMPLETED PLATE

This is the complete set of plates as reproduced for publication. The entire reproduction corresponds to division "G" in the other picture.

# PINE OIL

By JOHN L. BURDA, '17

*Research Chemist, The Newport Company*

TWENTY-FIVE years ago the commercial pine oil of today was unknown. Now the production of this interesting product in the United States alone (which is practically its only producer), amounts to about 2,160,000 gallons a year, or a daily production of 6,000 gallons.

Like the coal tar of the past, pine oil is a material of tremendous potential wealth as a valuable raw material of many diversified uses, which has hardly been exploited.

To the scientist seeking new unknown compounds; to the research chemist seeking new sources for solvents, camphor, synthetic rubber, etc.; to the industrialist seeking a cheap commercial product for many uses from a mosquito lotion to flotation oil, pine oil offers unlimited opportunities as a new and useful product worthy of thorough investigation.

Pine oil must be distinguished from pine needle oil, the latter being a long known essential oil, and its aromatic constituents are distilled or extracted from pine boughs, needles or leaves, and young pine shoots.

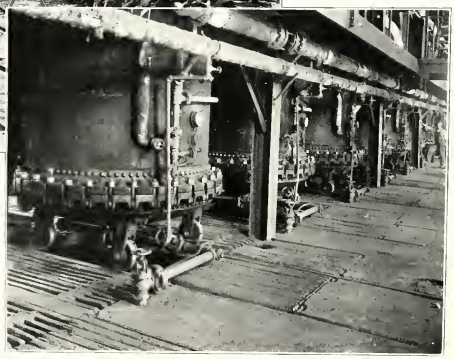
Pine oil came to the market as a by-product of the production of turpentine and rosin, by the steam and solvent process; and also as a by-product in the production of turpentine and charcoal by the destructive distillation of pine stumps and fat limbs of the pine tree.

The crude oil obtained by either of the processes is distilled and refined, the lighter portion collected as turpentine, and the heavier and higher boiling portion as pine oil.

In order to place upon the market a uniform product, certain specifications had been drawn up, and the crude oils are refined to meet these specifications.

Pine oil, therefore, may be defined as the oil recovered from the pine tree, either by steam distillation, extraction, or destructive distillation, and subsequently refined to separate the turpentine and conform it to certain definite specifications.

Pine oil is commercially recovered from the dead heart wood of the stumps and limbs of the long leaf (yellow) pine, and to a smaller extent from the other southern pines.



*Photos courtesy of The Newport Company*

Above, pine stumps as they come from the fields, ready to be chipped and shredded. Below, bottom view of a battery of six-ton retorts. Here the pine chips are steamed and extracted for turpentine, pine oil and rosin.

There are two general processes for the making of pine oil — the so-called steam and solvent process, and the destructive distillation process. Pine oil recovered from the first process is quite different from the second, particularly as regards to odor, so that the two are designated separately in the market.

The wood used is the same in either process. It consists of the dead pine stumps and fat limbs left over in lands cut over for timber or cleared for agricultural purposes. In the early days there were vast forests extending from North Carolina down the coast and through Florida and the Gulf states into Texas. The turpentine and lumber industries soon took most of the standing timber, leaving behind them a long waste land full of stumps and dead and down timber.

The living tree, practically speaking, contains very little pine oil in its cell structure. It does, however, contain in addition to its aqueous sap, what is called oleoresin, a crystal clear sticky fluid composed approximately of 22 per cent turpentine and 78 per cent rosin. The turpentine separated from very fresh oleoresin contains about 95 per cent alpha pinene, and this pinene furnishes the starting point for the development of the terpene derivatives found in pine oil.

As the cut stump is left behind, in the course of time the outer layer rots away, but the resinous heart material remains, the germicidal properties of the oleoresins preventing further decay. By the action of oxygen, water and sunlight the pinenes in the oleoresin gradually pass through chemical transformations, and the terpenes are oxidized to terpene alcohols and ketones, which later constitute the pine oil. The stumps generally selected for processing are over ten years old and by that time about 25 per cent of the turpentine has been converted into pine oil, the balance being the source of steam distilled wood turpentine.

By far the greatest amount of pine oil is produced by the steam and solvent process. This process was introduced

for the recovery of turpentine and rosin from pine stumps, and pine oil became a valuable by-product which soon found a varied market.

In this process the stumps are chipped and steamed in retorts under slight pressure, and the crude oil thus recovered is a mixture of turpentine and pine oil. This oil is subsequently refined by steam distillation and the turpentine is fractionated from the pine oil.

The chips are never steamed sufficiently to distil all the pine oil away from them. This would require the consumption of too much steam and time. The remaining pine oil is, therefore, extracted together with the rosin by means of a suitable mineral solvent, the boiling range of which is much below that of pine oil. This solution of rosin and pine oil in the mineral solvent is termed "liquor," and is subsequently refined by steam distillation, whereby the solvent and pine oil are separately recovered from the rosin.

The pine oil recovered by these two steps is combined and refined if necessary to meet the requirements of steam distilled pine oil.

The other process yielding pine oil is the production of charcoal by the destructive distillation of waste pine wood. The cordwood is placed in retorts externally heated, the temperature raised slowly until the turpentine and pine oil are driven off. Then the wood is destructively distilled for the production of charcoal. The oils are then refined for the recovery of turpentine and pine oil.

Some of the constituents of the wood are changed during the process of distillation, the products being turpentine, pine oil, pine tar oil, pine tar, pyroligneous acids and uncondensed gases which may be utilized for heating the retorts.

The pine oil thus obtained always contains products from the destructive distillation of wood which impart the empyreumatic odor so distinctive of destructively distilled pine oil.

In some plants the oils distilled before the wood commences to carbonize are collected separately and are consequently of much better quality. They should be really called dry distilled rather than destructively distilled.

The following discussion shall be based on the properties of steam distilled pine oil, as destructively distilled pine oil is essentially very similar, containing besides the main constituents of pine oil small amounts of empyreumatic bodies.

The color of freshly distilled pine is light straw. Water white pine oil, when such is demanded, is produced by redistillation over caustic soda.

The odor of pine oil is characteristically "piney." It is sweet and pleasant in the steam distilled product, but sharp and pungent in the destructively distilled product.

Pine oil has a burning taste with a woody flavor. It causes smarting of delicate membranes such as eyelids when in direct contact, but can be applied without harm to skin as a dressing for wounds and burns.

Pine oil has a free moisture content of about one-half per cent, which can be eliminated if desired by heating the oil to about 120°C. This free moisture will cause turbidity on dilution with naphtha and where such solutions are desired, the dehydrated oil must be specified.

*Photo, courtesy of The Newport Company*

General view of the Refinery. Stills for steam distillation in the background. Condensers and separators in the foreground.

Steam distilled pine oil is dextro rotatory, the specific rotation having the value of about plus 10 to plus 12.

The specific gravity of pine oil is about .933. Depending upon degree of fractionation; however, oils having a specific gravity between .930 and .945 can be obtained on specifications.

Pine oil on dry distillation starts to boil about 180°C and all of it (98 per cent) comes off below 225°C. The bulk of it distils between 200°C and 218°C.

The index of refraction of pine oil is about 1.4800.

The phenol coefficient of pine oil emulsions is about 4.

The chemical composition of pine oil affords an interesting study of the chemistry of terpene compounds. It is essentially composed of terpene alcohols and ketones, with small amounts of esters, terpenes and other bodies.

Terpineol constitutes the bulk of pine oil, its amount being between 65 per cent and 70 per cent. Next in importance comes borneol, present as 4.5 per cent to 5 per cent of the pine oil. Then comes a group of terpene alcohols such as fenchyl alcohol, the terpinenols, etc., adding up to about 17 per cent. The balance of the oil constitutes the terpenes, principally limonene and dipentene, and a small amount of a highly polymerized residue. There are also small amounts of esters such as methyl chavicol, particularly in old pine oil, or oil distilled over caustic.

The terpene chemistry has so far attracted very little attention of the practical chemist. It is true that the possibility of producing synthetic camphor from turpentine has been the first great impetus that resulted in greatly broadening the knowledge of the terpenes, but due to the price of turpentine and competition of the natural product, further advances have been discouraged.

Pine oil is the potential source of a great many useful chemical bodies and it may some day attain the glory of the long-overlooked coal tar products.

Terpineol is very readily converted to limonene and dipentene. These terpenes should become the starting point of a long chain of compounds. If the production of synthetic rubber should be ever developed economically from isoprene, dipentene and consequently pine oil, it will become the cheapest raw material.

Borneol is present in the natural state in pine oil. It is very readily oxidized to camphor. Under suitable market conditions every bit of the borneol could be recovered and converted to camphor.

The perfume chemist, looking for new synthetics, can work pine oil to yield aromatic esters, and he already finds in terpineol a very valuable carrier of perfumes.

The study of the terpene compounds is fascinating, the products are of pleasant odor, they are readily distilled and handled and the research chemist who is looking for an interesting line of work

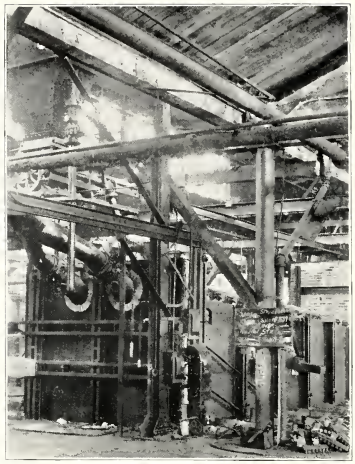
*(Continued on page 58)*

# HIGH GRADE MALLEABLE IRON

## Air Furnace Manufacture

*By* GEORGE B. STANTIAL, '23

***Chief Chemist and Metallurgist, Illinois Malleable Iron Company***



*Accompanying photos, courtesy of Illinois Malleable Iron Co.*
A representative air furnace equipped for burning powdered coal.

THE greater percentage of high grade malleable iron, containing less than 2.60 per cent carbon, which is produced in America is a result of melting in the so-called air furnace, although small quantities are produced by other means.

The air furnace is actually an open hearth, that is, the charge lays in a bath over which the flame passes and in doing so melts the charge and heats the bath of molten metal to a temperature desirable for its usage. This furnace is of a reverberatory type, but unlike the open hearth furnace used in producing steel, the flow of gases in most cases is non-reversible. However, in many installations these gases after passing through a furnace continue on through a waste heat boiler, the steam generated being a by-product of the process. Various fuels are being used for melting, chiefly oil and coal, the latter being fired in the lump form, and in the more modern installations the powdered form is used.

Now, as to the raw materials which are used in making up a charge for the furnace, the most important among these is pig iron which is made expressly for this work, this iron being low in sulphur and especially so in phosphorous content. Then, also, sprue (including gates and risers), hard iron scrap, purchased malleable scrap, a small percentage of structural steel scrap and if necessary some ferro alloys, constitute the charge. In current practice the size of charges varies from 8 to 30 tons, depending upon size of furnace, melting time available and manifestly, the requirements of the foundry. A sample charge is calculated herewith:

ANALYSIS

| | Pile No. | Sil. | Mn. |
|---|---|---|---|
| Pig Iron .... | 115 | 1.40% | .65% |
| Pig Iron .... | 129 | 1.55% | .70% |
| Pig Iron .... | 133 | 1.70% | .69% |
| Pig Iron .... | 138 | 1.50% | .75% |
| Sprue ..... ... | | .90% | .30% |
| Scrap ..... ... | | .80% | .30% |
| Steel ..... ... | | ..... | .50% |
| Ferro-Silicon . ... | | 15.00% | ..... |
| Spiegeleisen .. ... | | ..... | 20.00% |

| | Lbs. | Sil. Lbs. | Mn. Lbs. |
|---|---|---|---|
| Pig Iron ..... | 3,000 | 42 | 19.5 |
| Pig Iron ..... | 3,000 | 46.5 | 21 |
| Pig Iron ..... | 4,000 | 68 | 24 |
| Pig Iron ..... | 4,000 | 60 | 30 |
| Sprue ..... | 12,000 | 108 | 36 |
| Scrap ..... | 3,000 | 24 | 9 |
| Steel ..... | 1,000 | ... | 5 |
| Ferro-Silicon ... | 75 | 11 | .. |
| Spiegeleisen .... | 25 | ... | 5 |
| | 30,100 | 359.5 | 149.5 |

$$\frac{359.5}{30,100} \text{ lbs.} = 1.194\%$$

silicon in charge.

$$\frac{149.5}{30,100} \text{ lbs.} = .497\%$$

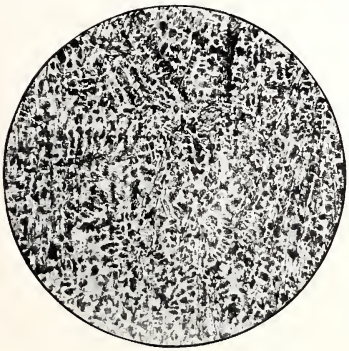
manganese in charge.

From the foregoing the percentages or "bases" of silicon and manganese are seen to be 1.194 per cent and .497 per cent respectively. These amounts are decided upon from knowledge of operating conditions over a period of time, and the steel is used for con-

A battery of potentiometer recorders which give running logs of all annealing cycles.

trolling the amount of carbon in the mixture. Although carbon is not figured in these calculations, it may be determined in the same manner.

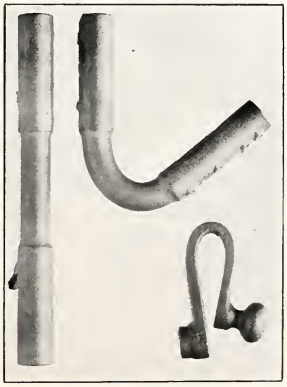
After these calculations have been completed, the ingredients called for are charged into the furnace, either by hand or machine. Fuel and air are supplied, the fire lighted and the "heat" is under way. It may be well at this time to emphasize the importance of the use of a low sulphur fuel. Iron has a strong affinity for sulphur and if this element is high in the fuel, the resulting metal will also contain a high amount, a condition which is detrimental to the physical properties of the finished product. The case in question is similar to the absorption of water by a partially saturated sponge. The furnace now being under fire, great care is exercised in controlling the amount of air supplied, thus maintaining a heavy fire, as little oxidizing as possible. Of course, in a city, the smoke ordinance must be complied with, but in general, a light visible smoke at the stack is a good indication of correct firing conditions.



A photomicrograph. Dark areas are pearlite, light areas are cementite.

As the charge melts down, furnacemen prod and work the remaining solid metal down into the bath by means of steel bars. When a considerable amount is melted, the slag is skimmed and removed through doors, built for this purpose. This slag contains the many impurities from the original charge and unlike steel practice, the slag is not built up with other materials to bring about certain changes, but is merely removed soon after its formation. This procedure is continued until the iron is totally melted and finally the last slagging leaves a bath of clean iron. During this period the end of a green, fir sapling, stripped and about 18 feet long is thrust into the bath and the iron is stirred and mixed by means of this. One would naturally believe that this bough would be burned up very quickly, being in contact with the molten metal, but this is not the case, for the moisture in the wood is heated, thereby generating steam and throwing the iron away from it. This action is somewhat violent and aids as much in the agitation of the iron as the mechanical manipulation of the bough itself. Following this a test ladle is removed from the bath, a test sprue poured and a sample cast for laboratory analysis.

The sample sent to the laboratory is pulverized and carbon as well as manganese determinations are made. This is known as a preliminary test (previous to tapping the heat), and knowing the carbon and having the test sprue broken and noting the fracture, one with experience can closely estimate the percentage of silicon present. The result of the manganese determination tells whether or not there is a sufficient amount present to combine with the sulphur, thus offsetting any troubles due to the latter element. Regarding this manganese sulphur ratio in air furnace practice, the manganese should be at least twice the sulphur plus 15 points; *eg.* if sulphur is .065 per cent, then manganese should be at least .28 per cent. Two more test sprues are made, the iron having been mixed at intervals with the green bough, and if their fractures, the preliminary analysis, and the test ladle results are satisfactory the heat is tapped. On the other hand, if these tests are not satisfactory, one of the advantages of air furnace melting presents itself; the metal is confined to the bath and additions of ferro alloys or steel may easily be made as the case requires. Manifestly, the iron is brought to a desired chemical composition and temperature suitable for the work at hand before the furnace is tapped, thus giving the most uniform metal possible day in and day out.



Example of the degree of bending that a high grade malleable casting will withstand.

Both laboratory samples and test bars are poured off during the heat, the former being analyzed for the following elements: silicon, manganese, sulphur, total carbon (of which all is in the combined form) and at times phosphorus. A typical analysis of high grade malleable iron is as follows:

| | |
|---|---|
| Silicon | .90 |
| Manganese | .30 |
| Sulphur | .065 |
| Phosphorus | .170 |
| Carbon | 2.35 |

From these figures it is seen that the silicon has been oxidized from approximately 1.20 per cent in charge to .90 per cent in cast, the manganese from 50 per cent to .30 per cent and comparing the analysis of the preliminary sample with that of the final, they are as below:

| | Preliminary | Final |
|---|---|---|
| Manganese | .34 | .30 |
| Carbon | 2.64 | 2.35 |

The amount of oxidation depends upon the fuel in use, the amount of air supplied, melting time and the individual furnace under construction. Various furnaces of like design have their own characteristics and tendencies, analogous to those variations possessed and exhibited by human individuals.

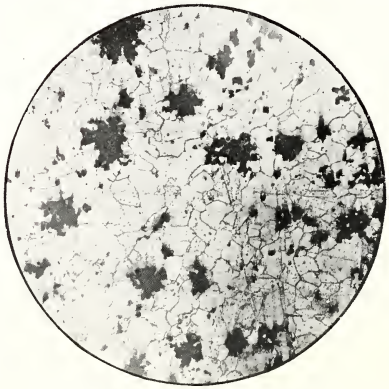
This iron as cast is truly called "hard iron" and in reality it is almost glass hard and readily shatters under a hammer blow. Upon breaking same, it presents a white granular fracture and in this state is not of commercial value, except in rare cases where hardness is desired. Practically, this iron is not machinable, would not withstand shock loads, and possesses no ductility. It is, therefore, necessary that it be malleablized and this is accomplished by annealing.

The castings, having been broken from their gates in the foundry, are cleaned

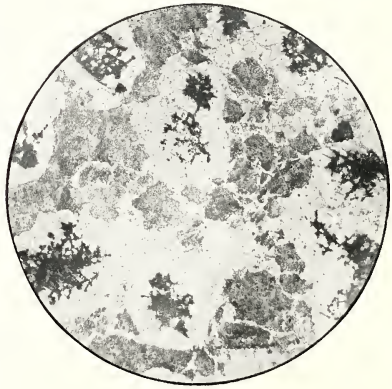
in tumbling barrels and pass on to the annealing room. Here the castings are placed in large iron pots which have permanent bottoms, in preparation for their anneal. These pots with bottoms are used so as to lessen the liability of warpage of the castings thus contained, as the pots are usually stacked three or four high during the process of annealing. Depending upon their size, shape and weight, a decision is made whether or not to use packing, and when necessary, packing is used to give support, thus preventing warpage. On the other hand, if it is deemed unnecessary to use same, the castings are merely placed in pots and usually a small amount of coal, charcoal or wood is also put in to insure a reducing atmosphere when under heat. It may be well at this stage to differentiate between packing as used in the American Black-Heart and the European White-Heart processes. In our process, when packing is used, it is of a reducing nature such as silica sand with possibly some coal screenings mixed in to make it of such a nature, whereas it is the European practice to use an oxide of iron (ore, pot scale, or mill scale) for a packing. If the reader will bear this in mind, the writer will at a later place explain the action and results upon the product in each case.

After the castings have been placed in the pots, the latter are stacked three or four high and sealed with fire clay and loam so as to make them airtight, thus preventing any oxidation (scaling) of their contents while being treated. These stacks are then placed carefully within an annealing oven, following which the door is put in place and sealed. The oven is then fired, the fuel may be oil, gas or coal, although in this process a high sulphur fuel does not influence the quality of the product. The temperatures are measured by means of a potentiometer indicator actuated from thermo-couples within the oven so that temperatures may be known at all times.

The oven is under fire and the temperature is increased to 1600° F. The time required to do this depends upon the nature and form of fuel used, and on the oven construction. Having reached this temperature, adjustments are so made to maintain it for a period of 55 to 60 hours. During this period, careful watch is kept upon all locations within the oven, and the temperature of regions which might be low is increased by means of flue damper manipulation; the ideal condition is to have all parts of the oven at the same approximate temperature.



A microphotograph of a specimen of well annealed malleable iron.



An exceptional example of bull's-eye construction in iron.

At the end of this period, firing is ceased, dampers closed, and the oven completely sealed to preevnt any possible entrance of air, and to aid in slow cooling. The oven is thus allowed to remain, cooling naturally at the average rate of 8° F per hour. It is imperative that the cooling proceed slowly through the critical range of the metal being treated. When a temperature of 1200° F has been reached, a few bricks in the front door are knocked out and other means of allowing circulation are employed. The oven then cools at a much faster rate and as soon as handling is possible the stacks of pots are removed and emptied. In general, this annealing cycle requires from 6 to 7 days.

The castings, after being subjected to this treatment, are soft malleable and upon fracturing, show a black, silky, fine grained fracture; hence the name "Black-Heart." The light colored grains are ferrite, which is itself a soft constituent; the dark splotches are free or "temper" carbon which has separated out during the anneal and these impart to the iron a valuable property, namely, ease in machining. Upon closer examination may be seen small inclusions of manganese sulphide, a visible means of ascertaining the chemical union of manganese and sulphur. In general, this annealing process, as explained in the foregoing, breaks up the hard constituents in the iron as cast, thus freeing the carbon and leaving chiefly ferrite and temper carbon. No doubt, some of the readers would like to know what a specimen looks like. A microscopic view of a specimen when it is only partially malleablized shows a very interesting structure which is sometimes called a "bull's-eye" construction. The dark central masses are composed of free carbon surrounded by grains of ferrite around which are to be seen fields of lamellar pearlite, the latter which has not been broken down into ferrite and carbon. There is a small amount of carbon lost in this process, but the greater amount of it is withheld; its form merely has been changed. Now, in the European practice, the oxidizing packing which is used, removes this free carbon and leaves a metal very low in carbon, thereby resulting in a tough metal with a white fracture upon rupturing, consequently the name "White-Heart."

Tensile test bars cast from every air furnace heat are annealed and sent to the laboratory where they are tested. Their diameters are measured by means of a micrometer caliper and markings made exactly two inches apart on their shanks. They are then placed in a

(Continued on page 58)

# MANUFACTURE OF CONCRETE BRICKS

**By LESTER E. GRUBE, '24**

***Sheboygan Brick Company***

THERE are three kinds of common building bricks, namely, clay, sand-lime, and concrete bricks; all of which are used throughout the country for building purposes. Concrete bricks have been used for the past twenty-five years in various parts of the country, particularly on the Pacific and Atlantic coasts, and in recent years have been used quite extensively in the Middle-west.

The increasing popularity of concrete bricks is due, no doubt, to the uniformity of their strength. The relation between the strength of the individual brick and the strength of the resultant masonry is an extremely complex one. It depends not only upon the strength of the brick, its size, bonding, mortar strength and thickness of the mortar joint, but upon the kind of material in the brick. As stated before, the material used in the manufacture of concrete brick is very easily governed, as to the quality and uniformity, so that a brick of rather uniform strength will result. The strength of a concrete brick will exceed that of a clay brick or a sand-lime brick by approximately twenty-five per cent.

Concrete bricks are now being used in the place of common clay brick in many localities, since they need not be handled any differently than common clay brick, and are used for exactly the same purposes. The costs of concrete brick and common clay brick are the same in practically all localities.

The quality of concrete brick is dependent upon:

(1) Cleanness and gradation of aggregate.
(2) Amount of mixing water.
(3) Quantity of cement in the mixture.
(4) Thoroughness of mixing.
(5) Efficiency of casting process.
(6) Moist curing.

Within the meaning of quality, as used above, are all the factors by which the suitability of concrete brick is measured—strength, absorption, suction, surface texture, brittleness, resistance to fire and other, less important, considerations. From this, it is seen that uniform quality can be secured through the proper manipulation of aggregates, water and cement, and of the mixing, casting process, and curing.

The aggregate used in the manufacture of concrete bricks is a coarse gravel. It must be clean, that is, free from organic impurities, such as humous and decaying vegetable matter, since such impurities have a lowering effect on the strength of the concrete brick. The gradation of the aggregate is as coarse as can be used; retaining workability and still producing acceptable surface textures. Using an aggregate with as

View showing bucket conveyor and relation of mixing plant to bin.

coarse a grading as possible will yield stronger bricks for a given quantity of cement and water than an aggregate of finer grading.

Within the past few years it has been discovered that for every concrete mixture there is a definite amount of water which, when used in the mixture, produces maximum strength. This is known as the water-cement ratio and any variation in this amount of water either to reduce or to add to the mixture, is accompanied by a large decrease in strength. The amount of water necessary to insure maximum strength in a concrete brick is the amount which will not cause the brick to sag or show any web marking when taken from the machine.

All other factors being constant the strength of any concrete mixture will be increased by adding, and decreased by subtracting cement. Portland cement must be proportioned with great care, because it is the most expensive ingredient in the mixture.

The more thorough the mixing, the more workable and the greater the strength of the concrete mixture. The materials are all dry mixed for two minutes and then water added and again mixed two minutes wet before being discharged from the mixer.

Power tampers over the brick machine deliver blows of the same intensity and of the same conditions of compressibility, therefore, giving a uniformly high grade product.

The moist-curing of the concrete brick is one of the most important operations in its manufacture. The hardening process of concrete brick, like all other concrete, requires both cement and water. The reaction of these two ingredients continues over a considerable period of time. As stated before, it is very necessary to have the proper proportion of water in mixing, and it is of just as great importance that it be maintained throughout the hardening period in order to take the full advantage of the cement used in the mixture. The water that is required during the curing of the concrete brick is provided by exhausting low pressure steam into the curing rooms.

As to the manufacture proper of quality concrete brick: the aggregate is received in gondola cars and unloaded into the building near the source of consumption. From this point, the aggregate is elevated to a large bin by means of a bucket conveyor. The bin is constructed so that the mixing plant is right below it. In having the bin so set, with relation to the mixing plant, the aggregate may be measured and dropped into the mixing plant. The mixing plant consists of a Blystone concrete mixer, having a capacity of nine cubic feet. The measuring hopper is filled with the aggregate and emptied into the mixing plant, to which one cubic foot (one sack) of cement is added. The cement and aggregate are then thoroughly mixed, to which the necessary amount of water is later added. A water pipe above the mixer furnishes the water for the mixing.

Thus, one man feeds, mixes and dumps his mixer. He first loads the

*(Continued on page 72)*

# WHAT PRICE KNOCK

## The Relative Price of Gasoline as Determined from Audibility Anti-Knock Tests

By DANIEL ROESCH, '04

*Associate Professor of Experimental Engineering*

FOR a number of years the price of gasolines for automobile engines has varied uniformly irrespective of the characteristics of the fuel. However, there are now available for general distribution gasolines which are sold at a premium of from three or five cents per gallon over the market price of the standard product. These fuels have been offered in increasing numbers principally because the public is willing to pay more for one fuel than for another, provided it has certain desirable characteristics. These distinguishing properties may be in the form of improved starting qualities, more complete combustion, better anti-knock values, or other desirable characteristics which may soothe the engine or result in more power, less carbon formation or less crank case dilution.

The following price analysis of various gasolines and blends is based only on their anti-knock properties in an engine of fixed compression ratio as determined by a method of testing developed in the Automotive Laboratory of the Armour Institute of Technology. The results may vary somewhat from those obtained when the fuels are compared by other methods of testing. The method used appears reasonable, however, as a basis of price determination from the car user's viewpoint of anti-knock values since it is a direct application method and made under conditions which are practically identical with those which the consumer uses and judges the fuel. It is also recognized that there probably will be variations in comparative results when examination is made under different mixture ratios, mixture temperatures (wet or dry mixtures), atmospheric conditions of temperature pressure and humidity, carbon deposit, combustion chamber shape, load and speed of the engine and engine design. The above are maintained constant as far as possible for this work.

The method is based on the experimental determination of the spark advance corresponding to various degrees of knock intensity. These data appear to furnish a reliable and valuable measure of the fuel's ability to operate without knocking or detonation under the specific test conditions except when extremely large spark advances are necessary to produce knocking.

The method of test[1] used for results as shown in Figure 1 consists of operating a constant compression engine at wide open throttle and at a constant speed of, say, 1,000 r.p.m. The spark is adjusted to various positions and the spark advances noted for various knock intensities based on the following code:

TABLE No. 1

Code of Knock Intensities

| Designation | Intensity |
|---|---|
| A | First Indication |
| B | Slight |
| C | Medium |

TABLE No. 2

Table of Relative Values of Raw Gasolines Based on Equal Anti-Knock Values. Index B-C Sp.Ad. = 26 (Blend Value = 18 cents per gallon)

| A | B | C | Notes: Gasoline used. |
|---|---|---|---|
| 26 | 26 | 26 | Index B-C Sp.Ad. |
| 71 29 | 79 21 | 100 0 | Raw gas benzol (Proportions by volume). |
| 18.00 | 18.00 | 18.00 | Total value of 100 gallons (Dollars). |
| 7.25 | 5.25 | 0 | Benzol cost at 25 cents per gallon. (Per 100 gallons of blend. Dollars.) |
| 10.75 | 12.75 | 18.00 | Raw Gasoline value (per 100 gallons of blend). |
| 0.151 | 0.161 | 0.180 | Raw Gasoline value (cents per gallon). |

TABLE No. 3

Table of Relative Values of Raw Gasolines Based on Equal Anti-Knock Values. Index B-C Sp.Ad. = 32 (Blend Value = 19 cents per gallon)

| A | B | C | Notes: Gasoline used. |
|---|---|---|---|
| 32 | 32 | 32 | Index B-C Sp.Ad. |
| 63/37 | 72 28 | 81 19 | Raw gas/benzol (Proportions by volume). |
| 19.00 | 19.00 | 19.00 | Total value of 100 gallons (Dollars). |
| 9.25 | 7.00 | 4.75 | Benzol cost at 25 cents per gallon. (Per 100 gallons of blend. Dollars.) |
| 9.75 | 12.00 | 14.25 | Raw Gasoline value (per 100 gallons of blend). |
| 0.155 | 0.167 | 0.176 | Raw Gasoline value (cents per gallon). |

TABLE No. 4

Table of Relative Values of Blended Gasolines Based on Equal Anti-Knock Values, and Prices of Raw Gasoline in Table No. 2.

Index B-C Sp.Ad. = 32

| A | B | C | Gasoline used. |
|---|---|---|---|
| 32 | 32 | 32 | Index B-C Sp.Ad. |
| 63/37 | 72 28 | 81 19 | Raw Gasoline Benzol. |
| 0.151 | 0.161 | 0.180 | Gasoline value from Table No. 2 (cents per gallon). |
| 9.54 | 11.60 | 14.58 | Cost of Gasoline in 100 gallons of blend. |
| 9.25 | 7.00 | 4.75 | Cost of Benzol in 100 gallons of blend (25 cents per gallon). |
| 18.79 | 18.60 | 19.33 | Total cost of blended fuel in 100 gallons (Dollars). |

Designation Intensity
D—Sharp
E—Severe

Necessary precautions are taken to establish as far as possible uniform operating conditions in the engine for all tests. Observations are also made of the power and representative curves established as shown in Figure 1. These represent results obtained with various blends of a benzol with a gasoline. The proportions vary from 100/0 of raw gasoline to benzol by increasing percentages of benzol to the 60/40 mixture having 60 parts by volume of raw gasoline and 40 parts by volume of the benzol. It will be noted that both the anti-knock properties and the power characteristics at constant compression are obtained. The latter data are considered incidental since the power benefits to be derived from an improved fuel are not directly shown. These benefits should be determined by direct tests in higher compression engines or by the use of a conversion factor.

The various knock intensities are given equal lineal values on the Y axis of the curve sheet and are plotted against spark advance. The intersection of these curves with the knock intensity corresponding to the mid-position of B and C Knock Intensity may be arbitrarily chosen for this work as a numerical valuation of the fuel's anti-knock value. This value has been designated as the Index B-C Sp.Ad.[2]

The power characteristics are also shown on this curve sheet and may be used for limited comparative purposes based on a fixed fuel air adjustment of the carburetor. The power possibilities of various fuels at their maximum permissible compression is not shown directly.

In case it is desired to determine the comparative price of three gasolines which are to be mixed with benzols, three series of tests as above described must be made. Representative summary data for these three fuels are graphically shown in Figure 2. Curve A represents a straight run gasoline of high end point; Curve B a fuel somewhat better in anti-knock value, and Curve C may be assumed to present a cracked fuel which has the least knocking tendency of the three fuels. Their respective knock characteristics are 14-, 20-, and 26-Index B-C Sp.Ad.

Tables No. 2 and 3 show data taken from Curve Sheet No. 2 and computations made to determine the relative price of each of the three raw fuels as based on their relative anti-knock values when determined by this test method. The method of computation is obvious from the notes in the tables.

Two conditions of anti-knock values have been assumed. Table No. 2 is based on a required anti-knock value of 26 and Table No. 3 is based on a required anti-knock value of 32. The prices as determined are believed to be fair and impartial for the conditions assumed and the method adaptable to many problems. The values of each of the three blends having an index value of 26 have been placed at 18 cents per gallon and the three blends shown in Figure 3 having an anti-knock index value of 32 have each been given an arbitrary price of one cent more per gallon, or 19 cents per gallon. Obviously, fuels having higher index values

(Continued on page 72)

[1]See S.A.E. Journal, July, 1926 page 17, and THE ARMOUR ENGINEER for January, 1926, for a more complete description of the method of test and representative data of various anti-knock and pro-knock influences.

[2]Other knock intensities such as the first indication ("A" knock) or other intensities up to a sharp knock ("D" knock) may be used. The comparative values will not necessarily be the same when using different knock intensities.

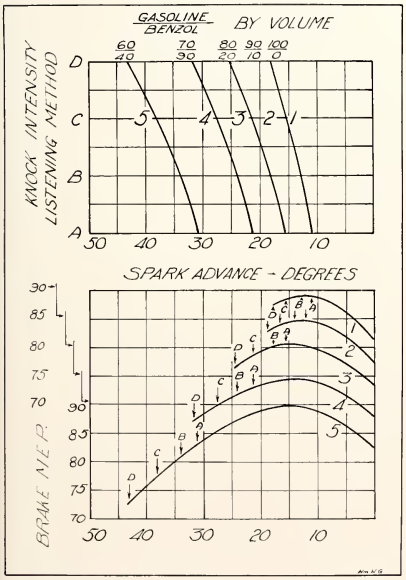



Figure 1. Representative data illustrating the effect that various gasoline benzol mixtures have upon the relation of knock-intensity to spark-advance.

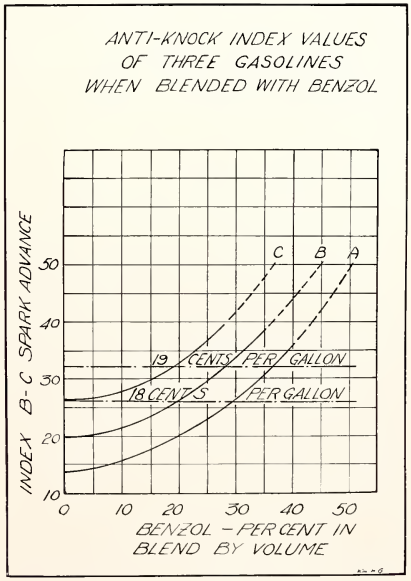



Figure 2. Representative data summarizing the results of the tests. The three curves represent three grades of gasoline benzol mixture.

# ONE OF THE GREAT RELIGIONS OF THE WORLD

## Confucius and the Chinese

By WALTER J. ZENNER, '28

*Student in the Department of Electrical Engineering*

THE study of China as a country is perhaps more interesting than the study of any other one country in the world. The Chinese Empire contains about five million square miles, which is more than twice the area of the United States. It is inhabited by five hundred million or about one-third of the human race, all living under the same government, ruled by the same laws, speaking the same language, studying the same literature, possessing a greater homogeneity, a history extending over a greater period, and a more enduring national existence than any other people, whether of ancient or of modern times. The atmosphere of permanence permeates the history of China. This nation and its institutions have outlasted everything. The ancient Bactrian and Assyrian kingdoms, the Persian monarchy, Greece and Rome have all risen, flourished and fallen—China remains the same. The legendary history of China would make it the oldest of nations. There is good reason to believe that it has an authentic history exceeding 4200 years. History further shows that the Chinese were leaders in scientific development. The Chinese have long been acquainted with the circulation of blood and inoculated for small-pox in the ninth century; printing was invented in the ninth century and bronze money was made as early as 1100 B.C. The mariners compass, gunpowder and the art of printing were made known to Europe by visitors returning from China. When we consider its high antiquity, its peculiar civilization, its elaborate and efficient administrative system, its philosophy and classic literature, its manufacturing industries and natural resources, China is perhaps the most remarkable country in the world.

What the original religion of China was, has been the subject of much controversy. Several types of religious beliefs had been formulated before the existence of any records. A reasonable conclusion is offered by Dr. Soothill who suggests that animism probably prevailed at first but at a very early date, farther back than our records take us, the recognition of one Supreme Being and a real Universe arose.

The most characteristic form which religion has taken in China is crudely animistic. All nature and all its parts are possessed of spirits, good and bad, weak and strong. They are to be found everywhere and everything that happens is accounted for by their actions. These spirits flit about through the air, invisible but very real. Streets must be made crooked because these imps move in straight lines and can be stopped in their wild career by a wall. Houses must be so constructed that a solid wall shall be opposite each gate, door and window. The spirits are divided between those which are good (shen) and those which are evil (kwei). The best way to keep off the harmful kwei is to secure the assistance of some powerful shen. The sun is a shen of the highest order and to secure his cooperation is to have the benefit of the most powerful influence in the contest. Everything connected with the sun is efficacious. The peach blossom, real or imitation, is an omen of good for it is a harbinger of spring. The cock who announces the dawn is also highly esteemed and his blood makes very good medicine. Heat, light, bonfires, firecrackers, torches, lanterns, candles, all kinds of noises—whatever suggests or is derived from fire may be used to bring good luck or prevent misfortune. This belief in spirits is deeply rooted and ever present, whatever else may be the religious belief.

*In the study of the religions of mankind, certain truths become evident. In all men, we find a desire to know God. This desire is more lasting and is more deeply rooted than any other of man's many desires. This thirsting for spiritual knowledge is apparent everywhere but has seldom been satisfied.*

*Although the desire is universal, no universal religion has yet been established. All of the various religions have certain ideas in common and on this common ground, certain groups are trying to build up a universal belief. There are good points to each religion but we also find ideas which we cannot accept. With knowledge comes understanding and, when we understand the desires and appreciate the accomplishments of men of other religious beliefs, it is almost impossible for us to withhold our sympathy. As we see men, in all countries, groping for a satisfying conception of God and as we stop to consider what they have found, we are more and more deeply impressed with our good fortune in having a leader like Jesus Christ to guide us.*

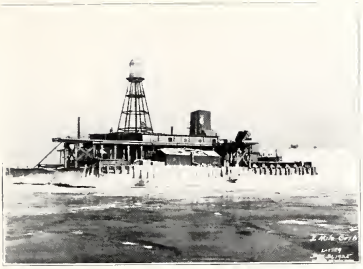
Ancestor worship is another side to this animistic religion. It is so universally practiced that it is looked upon as the very center and nerve of the Chinese religious life. Death in no sense breaks the bond between the members of a family. The family consists of its dead as well as its living members and, strangely enough to us, the dead members are more important than the living. All the arrangements of the family must be made with the comfort and well-being of the dead primarily in mind. The funeral is the most elaborate that the family can afford and sometimes more elaborate than the family can afford.

In addition to the all prevailing animism and ancestor worship, there is a state religion which shows the mind of the Chinese in a higher light. Since time immemorial, the greater objects of nature, such as the heavenly bodies, the earth and the sky, have been the great objects of worship. These were not supposed to be worshipped by the people themselves but by the state officers for them. Thus the august worship of the great gods becomes the duty of the state officials from the emperor down. The climax of the whole system is the worship of heaven performed by the emperor on the occasion of the longest night of the year. With beautiful suggestiveness, it is performed on that night when the forces of cold and darkness have done their worst. With the coming of the longer days, the increasingly warm influences of the sun give the first promises of the glory of the coming spring and summer. The service is held at the capital city and there is a sublimity about the ritual which indicates a deep spiritual meaning. Prayers are offered, which with little change, might be used in Christian churches. The worship is offered to heaven or Shang-ti. The conception of Shang-ti is so lofty that it is generally considered comparable with the Christian conception of God.

### Confucius and His Contribution

Confucius lived from B.C. 551 to 478. This was the age of feudalism in China. The whole country was divided into a large number of small states, frequently at war with one another and owing little more than nominal allegiance to the central government. This unsatisfactory condition lasted until the end of the Chao dynasty when the Chin dynasty began. The Chin dynasty lasted only

(Continued on page 74)



A view of the two-mile crib where shaft was sunk.

Drilling operations in the tunnel at the bottom of the shaft.

# THE CONSTRUCTION OF A CHICAGO WATER TUNNEL

## By WM. E. DOWNES, '26

ONE of the most interesting pieces of engineering work now being carried on in Chicago is the construction of a huge water tunnel from the present two-mile crib to the shore at the Chicago Avenue pumping station. This tunnel, two hundred feet below the level of the lake, will supply a large portion of the city with water when it is completed.

Due to the fact that a suitable location for a shaft could not be obtained on the shore, the tunnel was started at the crib. Naturally, this procedure created many problems which would not have been encountered had the project been started on the shore. The two-mile crib is situated about nine thousand feet east of where Chicago Avenue intersects the Lake Michigan shore line. A cofferdam was built around this structure and a shaft sunk. The shaft was faced with concrete as a safeguard to the workers below. It resembles a huge hollow cylinder, about twelve feet in inside diameter and three feet thick.

When an elevation of minus two hundred feet was reached, the actual work on the tunnel began. The problem presenting itself to the engineers was to definitely locate the direction and location of the horizontal tunnel. Timber was placed across the top of the shaft and by means of transits placed on this and transits on the shore, two points were located on the proposed line. From these points, piano wires were dropped to the bottom of the shaft. On the end of each was a heavy weight which was submerged in a pail of oil. This prevented excessive swinging of the wires. Since they were on the desired line, the wires provided means of prolonging the line from above down into the tunnel. Next, a point of definite elevation was located. This was done by careful measuring down the shaft. With the line and grade established, the rest of the work was not so difficult for the engineers.

The tunnel was blasted through solid limestone, requiring the employment of experienced miners and dynamite men. The order of work for the day was as follows: The engineers located the line and grade, showing the miners where to drill and blast; the miners drilled, set charges, and blasted; and the muckers shovelled, carted, and wheeled the loose rock back to the narrow gauge railroad. Here the rock was dumped into cars, hauled back to the shaft, dumped into the bucket, hoisted to the top, and dumped on scows or directly into the lake.

*Mr. Downes is one of last year's graduates from the department of civil engineering.*

*He is particularly well fitted to write on the subject of the Chicago water tunnel to the two-mile crib in that he spent about eight hours every day during his summer vacation a year ago at the bottom of the shaft. His job was that of running in surveys and levels.*

*Civils who availed themselves of the opportunity of seeing this project last Spring should find this article of exceptional interest since they had time to only glance at features of the work which required extended observation and explanation for complete understanding.*

*In this article, Mr. Downes incorporates both of these with the viewpoint of a worker.*

Each part of the above cycle had its characteristic difficulties. First of all, a definite line was required. This was located by the piano wires as previously described and prolonged through the length of the tunnel. Holes were drilled in the ceiling and wood plugs solidly embedded. The plugs were approximately on line and a nail, exactly on line, was driven into each. The spacing of the plugs was about twenty feet. A wire was attached to the nail so that a plumet lamp could be suspended from it. When two or more lamps were lighted, the center line of the tunnel could easily be determined with the naked eye. Each day it was necessary to locate precisely the center line of the tunnel and mark it on the face. A transit was set up directly under one of the line plugs. This would correspond to setting up the instrument over a point in field practice. A light was attached to one of the plugs farther ahead and the instrument sighted on the light. These two points located the line. The height of the instrument could easily be determined from a known elevation in the vicinity of the set-up. Knowing the height of the instrument, the slope of the tunnel, and the exact distance from the shaft of both the set-up and the face, the exact position of the center could be calculated. With this located, the exact positions of the miner's drill holes could be marked.

The drills used were of the Ingersoll-Rand compressed air type. The holes were usually drilled about fifteen feet into the face before they were loaded and shot. The process known as the bench method was used in the work to simplify matters as much as possible. The upper half of the face was drilled first and shot out. This left a bench below, upon which it was very convenient to set the miner's drills. On the next shot, however, both bench and face were drilled

and shot, leaving a new bench to work from.

The muckers, as the force which carries out the loose rock is called, follow the miners into the tunnel and excavate. They encounter considerable difficulty as the muck is piled to the roof at the face and is spread for a considerable distance down the tunnel floor. They must rig up scaffolding over which they wheel the rock back to the narrow gauge cars, take down the scaffolding when they are through for the day, and lay tracks and maintain the road-bed of the railroad.

In addition to the engineers, miners, and muckers, a considerable force of men had to be maintained to take care of the other work on the tunnel. Carpenters, to construct and maintain piers about the crib, replace shaft bracing, etc.; electricians, to take care of the lighting of the shaft and tunnel; hoisting engineers, to run the hoist, locomotive, and pumps; iron workers, to repair track, cars, etc.; and laborers for various odd jobs constituted the construction force.

Col. A. A. Sprague, Commissioner of Public Works, and John Ericson, City Engineer, are the men who are supervising the enterprise and A. G. Anderson (Armour, '09) is the engineer in direct charge of the actual construction.

## HIGH GRADE MALLEABLE IRON

(Continued from page 55)

standard tensile machine and pulled until rupture occurs, after which the elongation is measured and the tensile strength calculated in pounds per square inch. High grade malleable iron will possess the following tensile properties:

Ultimate Tensile Strength.....
.....50,000 to 55,000 lbs. per sq. in.
Elongation in 2".....10 to 25 per cent
Yield Point—approximate.....
.....35,000 lbs. per sq. in.

The ultimate tensile strength and elongation vary inversely as the carbon content in the hard iron, and also as to the nature of the anneal. An accompanying photograph shows the degree of bending that high grade malleable castings will withstand. The two larger castings are standard test bars, one in the form as cast, and the other having been bent with hammer blows. The smaller casting was straight from end to end before subjecting it to bending. These photographs should not lead anyone to believe that any malleable casting could be bent double without rupturing, for such is not possible in many cases, due to variations in size of section and design.

High grade malleable iron produced according to the foregoing methods and means will be soft and malleable, easy to machine, offer great resistance to shock and possess the tensile properties as have been mentioned.

In concluding, it is interesting to know that the automobiles in which we ride, the farm implements which make our harvests possible, the railroads which render such great services, the countless other machines which produce our commodities are partially made up of thousands of tons of high grade malleable casting.

## PINE OIL

(Continued from page 40)

will find in pine oil a very desirable raw material.

A product that is produced in such appreciable quantities as pine oil, must find a market for itself until its full benefits and uses are realized and turned into the most useful channels. A study of the following commercial uses of pine oil will reveal its most characteristic properties and open possibilities for further uses.

Pine oil now finds a ready market for the following uses: as a flotation oil in ore concentration; as a solvent in the varnish industry; as a thinner in the production of turpentine substitutes; as a germicide in disinfectants, deodorants, insectides and medicinal compounds; as a detergent in laundering and dry cleaning; as a raw material for the production of terpin hydrate and terpineol; as a raw material in the production of terpenes of lower specific gravity and higher volatility; and in various miscellaneous uses.

By far the greatest use of pine oil falls in its application as an excellent flotation oil for ore concentration. It is unquestionably one of the best oils for this purpose, particularly for copper ores, and its only limitation is price competition of other products.

Pine oil is generally used in the pure form. It is also applied effectively in many cases where a cheaper product is necessary in various dilutions with petroleum oils. Various resins and pitches are sometimes added, and the metallurgist interested in flotation processes should give pine oil its due consideration.

Pine oil exceeds turpentine in its solvent power for gums and resins. It is, therefore, greatly used in the paint and varnish industry, and its limitations are due to the low volatility of the oil. Where quick drying is not essential, it can be used to advantage, particularly in breaking up the difficult soluble gums. The addition of pine oil to mineral solvents has the double effect of increasing the solvent powers of the mixture and imparting a pleasant piney aroma. In this respect, it becomes valuable in the production of cheaper solvents as turpentine substitutes.

According to the U. S. Public Health bulletins, the phenol coefficient of pine oil is about 4.5. Consequently it is useful in the preparation of disinfectants and deodorants.

Pine oil is decidedly styptic, and exhibits pronounced anodyne and analgesic properties. The combination of medicinal properties and the fact that it is non-poisonous and will not irritate the skin has promoted its extensive use in liniments, healing salves for wounds, burns, skin infections, etc.

Pine oil is very extensively employed as a cough cure in syrups, and as an inhalant in the treatment of nasal and bronchial troubles.

Mosquito lotions and insecticides absorb a surprisingly large quantity of pine oil.

The growth of the use of pine oil as a detergent in laundering and dry cleaning has been phenomenal. For this purpose it is generally applied in the form of a solution of soap in pine oil generally known as "soluble pine oil" on account of the emulsifying properties with water.

(Continued on page 72)

# THE ARMOUR ALUMNUS

## J. WARREN McCAFFREY, '22, *Editor*

### RESULTS OF MAINTENANCE FUND DRIVE

Last year was probably the greatest and most important in the history of Armour Institute of Technology since its founding in 1893 under the benefaction of Philip Danforth Armour. The Alma Mater was saved for its alumni and the technical world when the means were obtained to make possible carrying the work of the Institute on, we hope, for an indefinite period of time.

On January 12, 1926, a contract was entered into between Armour Institute of Technology and Northwestern University which provided for the merging of the two institutions. Two of the most vital points of this contract are: first, the raising of a Maintenance Fund of $200,000 per year for the support of the Institute for five years, and secondly, after the successful raising of the Maintenance Fund, the greater task of raising the Capital Fund of $10,000,000 to be used for endowment, buildings, and equipment for the new "Armour College of Engineering and Architecture of Northwestern University."

The first stipulation of this contract, we are very happy to report, has been successfully complied with and, attending this fact, everyone concerned with the affairs of Armour Institute feels assured that the second stipulation will also be met with successfully. In the plan evolved by the Joint Trustees Committee, a group of men chosen from the Board of Trustees of both Armour Institute, Northwestern University, and public-spirited men interested in technical education, it remained for the alumni of Armour Institute to give evidence of their appreciation for what they had received while in attendance at college, and the fruits therefrom, as well as their loyalty for their Alma Mater by subscribing to the Alumni-Maintenance Fund. It was felt that, along with a few special gifts from benefactors and a thorough canvass of the alumni and former students of the Institute for pledges, the Maintenance Fund would approximate the required million dollar sum. However, when the facts were placed before the alumni, they responded in such a remarkable manner that their participation in the alumni fund was over 100 per cent more than the amount of the fund ascribed to them. In fact, at a dinner at the Blackstone Hotel, April 28, 1926, that sum conservatively estimated as being the limit of the alumni subscription was raised in a remarkably short period—less than two hours. Such indomitable spirit and loyalty to their Alma Mater cannot fail to have the necessary effect and inspire the members of the Joint Trustees Committee in undertaking their larger and more important task with a comparable spirit which certainly augurs well for the success of the Capital Endowment Fund.

There were several outstanding features in the alumni drive for funds which bore testimony to the stalwart loyalty of the alumni. The campaign was conducted under the auspices of the Alumni Campaign Executive Committee, the personnel of which included several very successful and influential Armour graduates in the city of Chicago. The chairman of this committee devoted his full time to the affairs of the drive without any compensation. This example

(*Continued on page 76*)

### AN INTERVIEW WITH F. D. CERF OF THE STUTZ MOTOR CAR COMPANY, CONCERNING F. E. MOSKOVICS

"Mr. Moskovics became president of the Stutz Motor Car Company in February, 1925. He took over his work with the feeling that there was no room in the motor car field for 'just another automobile,' but had definite plans for a high type car. Also, he knew that Stutz sales were at a standstill, that the factory was shut down because of being filled to overflowing with a stock of

F. E. Moskovics

finished cars and materials, and that only a handful of Stutz dealers were interested in moving this stock.

"From March, 1925, to January, 1926, Mr. Moskovics, single handed, disposed of the six-cylinder finished cars, fabricated and converted into cash, all obsolete materials on hand, and at the same time prepared and built from the ground up, the new eight-cylinder safety-Stutz.

"He introduced the new car at the New York Motor Show, January, 1926, where it was an instantaneous success. Mr. Moskovics personally sold to the retail trade 35 of the total of 175 cars sold at the show. A few weeks later, the Chicago sales numbered 251. In the year just ended, about 6,000 safety-8-Stutz cars were produced and sold.

"There are now about 500 dealers, located in all parts of the United States, Canada, England, France, Germany, Holland, Sweden, Norway, and Mexico.

"Mr. Moskovics' success may be attributed to several factors. He is a tireless worker, knows no hours, has unlimited strength and energy, and embodies that rare combination of salesmanship and engineering ability. He believes and preaches that 'A team that won't be licked can't be licked.' He knows practically every man in his organization, keeps in intimate touch with his dealers and sales-

(*Continued on page 76*)

### NEWS OF THE ARMOUR ALUMNI

Francis Gladhein Pease, '01, received his M. S. in 1924. Recently he announced in the public newspapers that $12,000,000 was to be spent on a new observatory and equipment on Mt. Wilson in California. Mr. Pease is astronomer and engineer of the Mt. Wilson Observatory at Pasadena, California, and lives at 824 North Holliston Avenue, Pasadena, California.

Ned I. Sosna, '19, is now a licensed architect with offices at 64 West Randolph Street, Chicago.

Frank J. Urson, Jr., '09, has been heard from recently. He is now a moving picture director with the De Mille Pictures Corporation at Hollywood, California.

The Gabriel Snubber Sales & Service Company at 5439 West 22nd Street, Cicero, Illinois, is owned and operated by Otto Kuehn, a former member of the class of 1922. We have no positive information, but we have very good cause for believing that the reason Otto did not stay in school until he had completed his course in mechanical engineering was a certain attraction at the National Kindergarten College. We feel pretty strong in our convictions that such was the case upon learning that a few years ago he married Helen Davison from that institution.

Rudy Lowe, '24, after six years in America, has elected to return to Europe to spend the holiday season. He left for New York on December 6, to sail immediately for Europe. He is going to Berlin to join his parents there.

This fall we received the announcement of the marriage of Vivian Marguerite Brindley to E. A. Goodnow, both of Chicago. It will be recalled that Goodnow was the tall, handsome bass singer who stood on the end of the semi-circle of the Glee club singers back in 1921 and 1922. If watched closely he could be seen nodding his head up and down, thus guiding the efforts of the choristers.

Edward L. Nelson, '14, has been actively connected with the radio development work of Bell Telephone Laboratories, New York.

On the first Monday after the date of the following, we received this announcement: "Mrs. William A. Jones announces the marriage of her daughter Marion Tilley to Mr. John McWilliams Stone (Armour '20) on Saturday, the eleventh of December, 1926, Chicago." The news was joyfully received at the Institute and the Armour Alumnus takes this opportunity to offer felicitations.

Gordon Gilbertson, '22, paid his respects at the Institute one day this fall. He announced that he had left the Victor Chemical Company of Chicago Heights, where he had been employed since his graduation and had gone into business for himself, manufacturing and selling chemicals as the Peerless Chemical Company. He reports his plant is located in Steger, Illinois, and he maintains an office in Chicago Heights.

(*Continued on page 76*)

# THE UNOFFICIAL OBSERVER

## By JAMES C. PEEBLES, '04

### THE FRESHMAN

The town from which the Freshman came is a small country village in the Middle West. It stands in the center of a rich farming region where the limitless wheat fields, dotted with a thousand tiny tents of the harvest, crowd upon it as if resenting its intrusion. And the regiments of tasseled corn, like serried ranks of plumed grenadiers, seem forever marching upon the village. Into a prospect not fully understood and seen but dimly, yet peopled with the friendly Ariels of his fancy, he went to begin a course in engineering.

In the township high school he had excelled in physics and mathematics, and the principal had advised him to take up engineering. Years ago this same teacher had hoped to become a lawyer, and had taken up teaching as a means to an end. But the years slipped by with accelerated pace and somehow he had never made the grade. There was nothing in his training or experience tending to familiarize him with engineering, so his advice to his student was based largely on academic considerations, an all too common failing with those who teach. He knew all the catch phrases, such as mechanical age, quantity production standardization, and the like, and his conversation was as full of platitudes as a party platform. When pressed for information as to the work of a graduate engineer, he was indefinite and unsatisfying, and fell back on glittering generalities. Soon the Freshman realized that he might be following an *ignis fatuus,* and determined to investigate the question for himself. So when he finally left home to take up the study of engineering in a great city four hundred miles away he was not *sent* by parent or teacher, but *went* by his own decision.

It was Sunday morning when he reached the city and his cousin, a young man who had finished his course in engineering several years before, met him at the station. The streets were quiet and almost deserted as they walked the few blocks to the elevated station, but at one corner which they passed it was Sunday on the calendar only. This was a huge hole in the ground, big enough to swallow completely the largest building in the home town. There they were preparing the foundations for a modern steel building, but the Freshman could see little but mud and water, clay and sand, the whole strewn with heavy timbers, jack screws, coils of cable, and a litter of hand excavating tools. "A most untidy mess," he thought, and inwardly he congratulated himself that he didn't do work like that.

As he leaned farther over the enclosing fence, the Freshman noticed almost directly below him a hoisting drum with a coil of cable wound on it. Beneath the timber supports of the drum he could see the opening to what looked like a well, and far below, like a distant headlight in a mile-long tunnel, he could discern a blinking electric light. As he watched, the drum spun around and a bucket coated with mud and clay, but otherwise empty, came to the surface. A young man dressed in rough working clothes and with a blue print roll in his hand, stepped into the bucket and was lowered swiftly to the bottom of the hole. "Who is that," asked the Freshman, as he turned to his companion. "That's the assistant construction engineer, in charge of all subsurface work. He's a graduate civil engineer, thirty years old, and has been with these general contractors for eight years. I think they have struck hard pan in this caisson and he has gone down to inspect it before they begin setting the reinforcing steel."

As they resumed their walk toward the elevated, the Freshman's thoughts were strangely mixed. "So that's a civil engineer; no mahogany desks or fine office rugs in his job; but, thank Heaven, I'm going to be a chemical engineer which surely must be more genteel than that."

After a day spent visiting with his cousin, and talking about the boys who had gone out from the old home town, of their failures and successes, the Freshman was shown early to his room on the third floor. Left alone for the first time since reaching the city, he felt as if he had lived a week since leaving home thirty-six hours before. After turning out his light he stood for a moment, as was his habit, before the window, just a bit disturbed by a fleeting nostalgia for the rustle of the wind in the corn leaves or the shimmer of the moonlight on the wheat stubble. But the only sound which reached him was the petulant whine of a trolley car or the muffled roar of an elevated train. Before him and above, the night was a black curtain hung in the vast proscenium of the heavens. Not even a star was visible to relieve the austerity of its sable folds, but suddenly as he glanced toward the southeast he saw a sullen glare of light shooting upward from the horizon, as if a single great red footlight had been turned on in the darkened celestial theatre.

The Freshman was sure that a serious fire was in progress and for some time he watched it with fascinated eye. But it seemed a long distance away and there was evidently nothing that he could do about it, so he dismissed it from his mind and went to bed. At breakfast the next morning he told about the fire which he had seen, and asked if there was anything about it in the morning paper. Everyone had a good laugh at the Freshman's expense when his cousin replied, "Yes, son, I've seen that fire many times; it's only the steel mills."

Throughout the day the Freshman tried hard to visualize the working conditions in that inferno whose flaming breath he had seen against the sky. "Surely," he thought, "engineers must work there, chemical, mechanical and electrical. What sort of profession is this for which I am about to prepare myself? I have seen the civil engineer, nearly a hundred feet below the street, tapping with his short-handled spade on the rocky ribs of Mother Earth. And I have seen enough of the steel mill to know that it is not a place of beauty and esthetic inspiration. I wonder how I will fit into the world of engineering, of which I have just had the first faint vision."

That evening as he sat with his cousin before the open fireplace where a flaming log was just sufficient to dispel the chill of the October night, he tried to express some of his misgivings. The older man listened and after the Freshman had finished he continued for a time to smoke his pipe in silence. Finally he aroused himself as from a revery, and looked at the Freshman as if seeing him for the first time.

"I know exactly how you feel, lad, for ten years ago, I went through exactly the same experience. Just now much of the engineer's work may seem to you grim and unlovely, and you wonder if you will like it. But later you will experience the satisfaction which comes from hard things well done, from difficulties overcome, from ugly things made beautiful. And let me tell you this, young man, the college to which you are going will help you, in a greater measure, than any other I know, to find your proper orientation with respect to your job. There you will find no ivy covered walls or stately campus elms, no fragrant daisy chains or beguiling coeds. You will find rather buildings which contribute more to engineering than to esthetics, equipment of a type and size that will familiarize you with actual engineering practice, and a faculty many of whom know from experience something of the stress and storm of competitive industry."

The speaker stopped to fill and relight his pipe, an exacting task which required his undivided attention. The Freshman felt, however, that if he was just wise enough not to butt in, the lecture would soon be resumed. In this he was not disappointed, for pipe and lecture were soon off again to an even start. "You know, kid, there are many colleges and universities in this country where they are vastly concerned about the cultural and esthetic training of the engineer. Throughout his college career they would surround him with all the refining influences of French and femininity, and then at Commencement they graduate him *cum laude,* and with a sheepskin in his hand, a brave song of 'Alma Mater' on his lips, and in his ears the chapel chimes playing 'Til We Meet Again,' they send him out to dig sewers. No fall in all history, from Adam to McGinty, is comparable in tragic irony with this. For five or six years he has been playing at engineering with tin cans and nut crackers, instead of with high pressure boilers and large capacity testing machines. Then he goes out to face a painful period of readjustment before he can bring his college-fostered notions into line with reality. The school where you are going will make no such mistake as this. All through your course you will be in touch with realities, you will learn to see behind the inevitable noise and dirt the goal of worth-while accomplishment. You may even learn to take a fierce pride in your overalls and your dirty hands because they are the symbols of your effort to make unwilling Nature serve your purposes."

Again the speaker stopped and smoked in

(*Continued on page 78*)

#### LABORATORY LEXICON

*Experiment:* An exercise in the fine art of invention, involving the conception of a set of causes adequate to bring about a predetermined effect.

*Reports:* The student's Yellow River, for they are never finished, and the professor's River Styx, on the near bank of which he lays the last one down.

*Statics:* That branch of science which explains how a man may be no wiser and no more capable today than he was twenty years ago.

# THE ARMOUR ENGINEER

Published Quarterly by the College of Engineering

## ARMOUR INSTITUE OF TECHNOLOGY

Vol. XVIII January, 1927 No. 2



STAFF

Wm. W. Gothard ..... *Editor*
James D. Green ..... *Business Manager*

W. J. Zenner ..... *Assistant Editor*
J. J. Doheny ..... *Articles Editor*
T. P. Camp ..... *College Notes Editor*
J. W. Kent ..... *Fraternities Editor*
H. Kohn ..... *Societies Editor*
F. D. Payne ..... *Athletics Editor*
C. W. Burcky ..... *Engineering News Editor*
J. W. Urban ..... *Art Editor*
H. B. Ritman ..... *Art Editor*
C. Long ..... *Humor*
L. A. Ohlinger ..... *Publicity*
F. C. Steinhaus ..... *Publicity*
M. T. Goetz ..... *Photography*
L. K. Sairs ..... *Circulation Manager*
W. A. Morgan, C. Vander Molen ..... *Editorial Assistants*
C. A. Gustafson, R. H. Bates, G. H. Von Gehr, C. L. Lohner ..... *Business Assistants*

Professor C. E. Paul ..... *Advisory Editor*
Professor J. C. Pebbles ..... *Unofficial Observer Editor*
Mr. J. Warren McCaffrey ..... *Alumni Editor*


**Our Slogan:** ***Make The Armour Engineer the best technical college publication in the country***

*A set o' dull, conceited hashes*
*Confuse their brains in college classes!*
*They gang in stirks and come out asses,*
*Plain truth to speak!*
—Burn's *Lines to John Lapraik.*

FROM a casual observance, it would appear that in order to qualify as a writer for leading American literary periodicals it is first necessary to have a definite and well formed distaste for American standards, and an apt and ready style for a seemingly orderly, though illogical presentation of so-called existing abuses.

A discourse on, "The Real Revolt Against Civilization" in one of the supposedly better magazines contains the following statements: "I should rather live in Peking, thrice as filthy, because it is interesting and touched with beauty and romance, than in New York, clean, because it is ugly and dull and blatant.

"I myself sometimes find the stench and grime of China unendurable, and luxuriate now in New York bath-rooms.

"Not without point has it been said that the white race has surpassed others only in music and plumbing."

In this we find an indictment for the engineer.

It must be admitted that the white race has presented potential possibilities, even if it has lost them in its quest for superior plumbing.

And, if its surpassing qualities had not been music and plumbing, they might have been music and philosophy, or possibly music and literature. In any event, the responsibility for our success in the perfection of a dull, ugly, and utilitarian enterprise such as plumbing rests entirely with the engineer in that it was he who directed our efforts in this line. His genius caused us to develop a desire to luxuriate in perfect bath-rooms. Had it not been for his dominating influence in molding our tastes we too might have the privilege of living in a land touched with beauty and romance and a stench comparable to that of China. We have been robbed of the opportunity of extracting a perfume which by contrast with the stench suggests paradise itself. Filth has been removed with the result that we now have nothing with which to compare our efforts at creating beauty. Misery has been alleviated, the unclean leper has been banished from society; everything that holds interest-stimulating possibilities has been done away with.

The cause of the impending downfall of a civilization is laid at the door of the engineer. In order to check the spread of the fundamentals of our civilization, let us "inoculate the social system of such so-called cultural countries as India, Egypt, China, and Siberia against industrialism (and plumbing), as we should against a plague."

But, let us take consolation in the fact that our civilization, with all of its abuses, has the virtue of providing leisure for these contributors to our leading periodicals in order that they in their self appointed way, may effectively sound a note of warning and turn us from the evil of our ways; and that the blatant masses provide financial support and luxurious bath-rooms to facilitate their further observations.

---

THE New York Public Library has collected a file of the Armour Engineer. This file is not complete and they request our assistance in making it so.

In a recent communication, they inquire if there are any, among our readers who have saved their copies and who would be willing to present them to the New York Public Library on the understanding that the file will be taken care of and preserved permanently.

The following are the copies desired:

Vol. 1, 2 and 3, all issues.
Vol. 10, No. 1.
Vol. 14, No. 1.

The Armour Engineer will consider it a courtesy if this file is completed. Communications may be sent through the office of the editor.

---

IT makes little difference in our opinion what position we may occupy in industrial life, what remuneration we receive, or what authority we may be called upon to exercise, success or failure in the true sense depends in important measure on whether we are or are not in love with our job.

It was our privilege recently to talk with a railroad man who has in a remarkably short time risen from a subordinate position in the service to the head of an important system. In the course of our conversation he said: "Railroading has always fascinated me, and I am as much in love with it now as I was the day I got my first job. Do you know," he continued, and his countenance bore manifest evidence of sincerity. "I would prefer spending an evening in a big freight terminal watching the shifting of the cars under the expert guidance of the yardmen than to sit through the best show that was ever put on a Broadway stage."

If this man had not loved his job, if he had merely "held down" that first position, he would in all probability never have risen far above it, and instead of directing the destinies of a great railroad he would have continued as a cog in the wheel of the industry he had chosen for his life's work.

We have no desire to preach, and this simple recital of facts is in no essential a sermon, but an incident which truly portrays the dividing line between progress and stagnation, success and failure, and to direct attention to the truism that the man who is really worth while and contributes to rather than detracts from human progress is he who loves his job and everything connected therewith.

—*The Railroad Employee.*

# COLLEGE NOTES

## *A New Chemical Engineering Society Organized; Scholastic Standings Published*

A NUMBER of men in the chemical engineering department met on the evening of December 16. As a result of this meeting a club was formed, the name of which for the present is to be "The Chemists Club."

This club fills a long felt want, as it will serve to bring about a closer association of the members of the different classes as well as to give a chance for discussions and entertainments.

Mr. Urban, in recognizance of his efforts in arousing the interest of the students and faculty in the organization, was made its first president. The other officers are:

*Vice-President*.....G. C. DUFOR
*Secretary-Treasurer*.....G. L. PARKHURST

Meetings of this new organization will be held every Tuesday and Thursday. The place of meeting will be announced later.

---

A hurried survey of work done during the holidays shows that many of our men were busy helping Uncle Sam move the heaviest Christmas mail ever handled.

---

OUR new jazz orchestra, Stresses and Strains, introduced to the school at the concert given by the glee club and orchestra, proved to be a harmonious collection of excellent musicians. Let us hope they appear frequently and for long periods of time at future assemblies.

---

Wednesday, December 15, the coldest day of the year, was chosen as the day for an all-day out-door inspection trip by the senior Chemicals. Came the dawn there appeared several sheepskins, many lumberjack shirts, heavy shoes, and even two headsets. Before the trip was over everyone was thoroughly convinced that while the trip was a good one (lunch furnished free of charge), it was rather a poor day to spend wandering around a lot of very well ventilated, unheated buildings.

---

The Armour Tech Fellowship club, organized to take up the work of the old Armour Branch of the Y. M. C. A., reports good progress in the matter of memberships. Just at present a new radio set is being constructed, and any parts, new or old, will be thankfully received. Tubes and a good storage battery will be especially appreciated.

---

Perseverance is very desirable in an engineer, to be sure, but it can be carried too far.

As you probably know, our sign was removed from the board by some collector of art. A notice requesting its return was then posted. This was also removed, supposedly by the same collector. We appreciate his sense of humor, of course, but we really would like to have the sign back.

THE following statistics, compiled by the Dean, give the scholastic standings of the members of the freshman, sophomore, junior and senior classes of the College of Engineering and Architecture who were in attendance during the second semester of the college year 1925-1926. In this computation the grades in Physical Training were omitted. A credit (Cr.) either for work at the Armour Institute of Technology, or for work elsewhere, was considered equivalent to a grade of "C."

The average of the entire college body, a total of 688 students, is 86.1%.

The average of the various organizations are as follows:

The Senior Class .....87.7%
The Junior Class .....86.8%
The Sophomore Class .....85.2%
The Freshman Class .....85.4%

The student with the highest average in the senior class is Mr. Charles M. Nelson. His average is 96.5%.

The student with the highest average in the junior class is Mr. Leo A. Chlinger. His average is 95.2%.

The student with the highest average in the sophomore class is Mr. Leslie J. Anderson. His average is 96.4%.

The student with the highest average in the freshman class is Mr. Joel M. Jacobson. His average is 96.8%.

Mechanical Engineering Department..86.5%
Electrical Engineering Department...86.8%
Civil Engineering Department.....85.6%
Chemical Engineering Department....87.1%
Fire Protection Engineering Dept....86.4%
Architectural Department .....84.3%

THE HONORARY FRATERNITIES

Tau Beta Pi.....92.6%
Scarab .....86.5%
Eta Kappa Nu.....91.1%
Phi Lambda Upsilon.....90.6%
Salamander .....92.4%
Chi Epsilon .....91.3%
Pi Tau Sigma.....91.9%
Sphinx .....87.9%

SOCIAL FRATERNITIES

Phi Kappa Sigma.....86.5%
Delta Tau Delta.....85.1%
Theta Xi .....84.9%
Sigma Kappa Delta .....88.3%
Phi Pi Phi.....85.5%
Triangle .....88.0%
Sigma Alpha Mu.....87.5%
Rho Delta Rho.....84.4%
Beta Psi .....86.6%
Kappa Delta Tau.....88.0%

CLUBS

Athenian .....85.6%

The average of all students belonging to the Phi Kappa Sigma, Delta Tau Delta, Theta Xi, Sigma Kappa Delta, Phi Pi Phi, Triangle and Beta Psi fraternities (Fraternities that rent or own their own chapter houses) is 86.3%.

The average of all other students is 86.0%.

In the computation of averages the following numerical values were given to the letter grades:

A=97.5
B=90.0
C=80.0
D=67.5
E=50.0
Cr=80.0

AT last the answer to the question, "Who Is He?" is about to be made public. The popularity contest held by the *Cycle* to determine the most popular man in school made a wonderful start and coasted to a finish on Friday, December 17. No one knows yet who he is. It might be you.

---

Mr. Kelly tells us that the Dean's office was serenaded on December 16 by a group of very earnest young gentlemen, the occasion being the semi-annual sing-fest of the pledges of Tau Beta Pi. It has been suggested that their reportoire be increased and that they give an outdoor recital sometime in the near future.

---

Mr. I. B. Lehman, who spent the summer and fall working for the Brunswick-Balke-Collender Company in Muskegon, reports that Michigan is too cold in the winter, and that he will be back with us at the beginning of next semester.

---

PROFESSOR WHITE, of the gas engine laboratory, has left Armour Institute and gone to South Bend to take up work at the proving grounds of the Studebaker Company. We are sorry to lose him, but our best wishes go with him on his new work.

---

### WE BEG YOUR PRADON

In the November issue of the ARMOUR ENGINEER, on page thirty-one, under the heading of the ARMOUR TECH ATHLETIC ASSOCIATION, an error in typesetting occurred. The second item (5,580.00) in the right hand column is the difference between the first two items (6,324.00 and 744.00) of the adjacent column.

This item (5,580.00) belongs in the third place in the second column from the right.

---

### PRESS CLUB

It has been announced before, and we still maintain that other things being equal, the most positive way of becoming associated with the Armour publications is by an active association with the Press club.

At the December meeting we had for our speaker Mr. Harold W. Munday, '23; the present editor of the trade journal, Pit and Quarry. His talk was humorous because of the ludricous light in which it placed some of our preconceived notions; it was serious in that it brought out an application of engineering training that many of us had not considered, or even known of before; and it was genuinely worth while because it gave us some idea as to what circumstances we may have to deal with when we graduate from Armour.

The officers of Press club are:

*President*.....W. W. GOTHARD
*Vice-President*.....F. D. PAYNE
*Treasurer*.....M. T. GOETZ
*Secretary*.....J. W. URBAN

# FRATERNITIES

*The Armour Spirit is Nurtured by Her Fraternities*

## TAU BETA PI

Beta of Illinois takes pleasure in announcing the pledging of the following men:

SENIORS:

W. A. COLLINS
F. J. EWALD
J. D. GREEN
R. A. HARSCHNEK
C. E. HERBST
L. F. JOHNSON
F. A. NELSON
G. L. PARKHURST
A. R. WAEHNER
E. C. YOUNGBERG

JUNIORS:

L. J. ANDERSON
K. H. PARKER
G. H. VONGEHR

The pledging ceremonies took place on Tuesday evening, November 16, in the Tau Beta Pi rooms. Several of the faculty members participated in the activities. The above group is one of the largest ever pledged by this chapter.

The initiation banquet was held on Saturday, January 8, at the Brevoort Hotel. A fine meal was served to the sixty or so, actives, neophytes, alumni and faculty members. Professor Freeman acted as toastmaster.

## SPHINX

Those who at present officially represent Sphinx are:

*President*.....D. B. DAVIDSON
*Secretary-Treasurer*.....W. W. GOTHARD

For the information of those who may not know, Sphinx is the honorary literary fraternity of Armour. Its membership is composed of students who have done distinctive work on the ARMOUR ENGINEER and *Cycle* staffs.

It is our privilege to announce that the following have been elected to wear the yellow and black pledge ribbon of this organization:

C. W. BURCKY
T. P. CAMP
J. J. DOHENY
J. D. GREEN
J. JANAK
M. H. LAMM
F. D. PAYNE
W. J. ZENNER

## ETA KAPPA NU

On the third of November, Delta chapter of Eta Kappa Nu held its regular pledging banquet at the Electric club of Chicago. At this banquet Delta chapter conferred pledgeship upon the following men:

SENIORS:

C. A. BECHMAN
G. E. COOLE
G. E. KENNY
E. H. MADDEN

JUNIORS:

L. J. ANDERSON
C. W. WITTGREN
I. B. LUETH

Brother A. A. Hoffman, '18, of Delta chapter, was the speaker of the evening.

The principal events of the pledging period, were an alumni inquisition held on November 23 at the Beta Psi house, and a short but intensive informal initiation on December 9 in the chapter rooms. The formal initiation was held December 15, at the Electric club. On this occasion the pledges were decorated with the key of Eta Kappa Nu.

It was the good fortune of Delta chapter to meet with the Chicago Alumni chapter at a banquet held on December 7 at the Hamilton club. Brother R. E. Hattis was the speaker of the evening. He is associated with the firm of W. L. Ferguson & Co., engineers employed by Northwestern University to design and construct the University building on the McKinlock Campus. After the banquet, an inspection trip was made to the campus.

Delta chapter wishes the faculty and students a prosperous New Year.

## PHI LAMBDA UPSILON

Omicron chapter pledged three promising candidates on the evening of November 12. They were:

SENIORS:

J. F. DOHENY
E. C. YOUNGBERG

JUNIORS:

G. A. CRAPPLE

The initiation and banquet was held on Saturday, January 15, at the Hamilton club. The assembled members and alumni were instructed by the initiates in the intricacies of researches leading to the discovery of the universal solvent.

Phi Lambda Upsilon extends the best of wishes for the New Year.

## CHI EPSILON

Chi Epsilon, the civil honorary fraternity, held its first banquet of the year on December 8, at the Brevoort Hotel. The event was a pleasant one at which many of the alumni and the honorary members were present to welcome the new pledges who became their fraternity brothers at this gathering. We were very glad to welcome our friend Professor P. C. Huntley, as an honorary member of Chi Epsilon at this meeting. Professor Huntley, while not in the civil department, is a graduate of the civil engineering course.

Far from the least interesting and enjoyable part of the program were the odd and humorous reminiscences of their connections with Armour's early history as told by the professors in moments of confidence.

Succeeding the acceptance of new members, the following officers were elected for the second semester:

*President*.....B. Z. CAILLES
*Vice-President*.....L. A. OHLINGER
*Treasurer*.....J. C. HARROWER
*Recording Secretary*.....A. J. SLATALLA
*Corresponding Secretary*.....P. A. GRAF

## SALAMANDER

Salamander has added to its roll three men who have qualified in every respect for membership in the honorary fire protection engineering fraternity. They are:

SENIORS:

W. H. ALEXANDER
R. G. OSGOOD

JUNIORS:

K. H. PARKER

These men received the black and red pledge button on November 9. Since then, they have made their first and probably their last appearance on the stage. This was in the form of a one act silhouette at the Fire Protect smoker on December 8.

The initiation was held on December 16, and everyone went home for the holidays ready to spend a Merry Christmas.

## PI TAU SIGMA

The past few weeks have been very eventful for Delta chapter. Just previous to Thanksgiving, Brothers Schroeder and Harshnek attended the annual convention which was held at the University of Wisconsin. The delegates reported that they had a very pleasant time.

After a comparatively short pledge period the following men were initiated into Delta chapter:

SENIORS:

A. J. BUETER
J. C. SEGELER
W. E. VEVURKA

JUNIORS:

E. M. CLARK
E. B. KAPKE
L. E. JOHNSON

At the initiation banquet held at the University club, December 14, we were well pleased to see a large attendence of alumni and faculty members.

## DELTA TAU DELTA

Delta Tau Delta is proud to introduce the following pledges, whom we think one of the best groups to ever wear the Delt pledge button:

R. H. BATES
C. BEAL
R. B. BUTTERWORTH
R. G. COURTNEY
R. E. EMMONS
B. F. KENNY
R. T. MCGUIRE
W. P. MCKINNIE
H. W. MONTGOMERY
N. J. NOVY
J. E. RANSEL
C. P. SOMERVILLE
A. T. U'REN

As usual, the rushing season was a busy one. The climax was the dance given Friday night, October 15, for the pledges. The music was fine and the crowd congenial.

One of the features of every Delt year is the annual Doc Weiland pledge banquet. At this affair the genial Dr. Weiland, one of Chicago's foremost surgeons and a past president of the fraternity, is host to every Delt pledge in the country who can possibly

attend; and most of them do, much to Dr. Weiland's joy.

The next big event on the social calendar was the pledge party, given by the freshmen to the actives on Friday night, December 17. This party is an annual event. A novel idea was used; the house was turned into a realistic cabaret with all the features that one would find in any of Chicago's leading night clubs.

We were glad to be permitted to turn the house over to the W. S. E. for their smoker on November 17.

## PHI KAPPA SIGMA

Alpha Epsilon chapter now has a pledge membership of fourteen men. We are hoping that they will be successful in their studies so that a new list of actives may be added to the chapter roll next semester.

The first Sunday following the Thanksgiving vacation was set aside by the chapter as Parent's Day. This is an annual affair and in the afternoon the chapter acted as host to the parents of those members whose homes are in Chicago. In the course of the afternoon entertainment was furnished after which a light lunch was served. The chapter feels that it was a most successful party.

As was naturally expected, the house was nearly deserted during the Christmas holidays. Several of the fellows stayed here over the vacation but most of the out-of-town men returned to their homes to spend Christmas.

Of course, it is not so easy to return from two weeks of pleasure and recreation to face the coming semester examinations. It is, however, a well established fact that hard labor causes us to have a greater appreciation of our pleasures. So, if we can be quite optimistic, we might look at the circumstances this way and see that things are not so bad after all.

## THETA XI

A fraternity is necessarily an organization composed of a group of men whose aims and ideals are the same; whose school activities and social relationships are so unified that each man typifies the fraternity's standards. Thus when one speaks of a fraternity, he speaks of an organization that embodies the spirit of the group. Too often the spirit in a fraternity is self centered and too little attention paid to the men in other houses and to the school in general.

It was for this reason that Theta Xi was especially glad to be able to have the smokers of three A. I. T. societies at the House this fall. By this means it was possible to establish friendship between men who probably would never have met. One is also brought quite forcefully to the realization that the fraternity is a school organization, and its interests are the same as those of the school and the students at Armour. We certainly enjoyed having the men over to the house and we sincerely hope that they enjoyed their evening with us.

The results of the inter-fraternity basketball contest are well known, the Phi Pi Phi's winning the cup and Theta Xi coming out second, after two grueling games that followed each other by only four hours. We are mighty proud of the fellows for their fine work this season. The same group will be out for the cup next year.

The sixty-third national convention of Theta Xi was held at the Benjamin Franklin Hotel, Philadelphia, on December 28-29. The convention was a large and enthusiastic one, well represented and well qualified to carry on the traditions and spirit of the fraternity.

Theta Xi is glad to announce the pledging of the following men:

P. E. Heath
J. E. Higgins
W. A. Johnson
W. E. Kidd
J. E. Louis
M. Saunders
K. Simpson
D. Smith
A. Tully

## SIGMA KAPPA DELTA

A resumé of the fall activities of Sigma Kappa Delta would involve a great many details which might well be omitted. But there have been quite a few activities and events well worth a word of comment.

Notable among these is the first house dance of the year, held on October 15, at which a number of freshmen were entertained. A group of the alumni returned for this dance, and it was declared that a very enjoyable evening was spent. Brother Tatar, now one of our alumni, is furnishing the music this year, which will undoubtedly be a big factor in making our dances as successful as they have been in the past.

The Christmas dance and party on December 18, was very well attended by the actives, pledges and alumni. With the house filled with Yuletide decorations, a bit of the Christmas spirit wove itself into the dance, thereby distinguishing it from the succeeding ones. The favors, we hope, will serve as pleasant remembrances of the Sigma Kappa Delta Christmas dance of 1926.

The active chapter is proud to announce the pledging of the following men:

W. A. Anderson
R. S. Benson
C. A. Blomquist
D. R. Bray
L. E. Coe
G. B. Cornwell
P. S. Deiwert
D. Finlayson
W. M. Klopsch
H. J. Koeber
V. A. Peterson
E. B. Ross
W. C. Schmidt
C. E. Siebert
F. E. Williamson

As we enter upon this new year, Sigma Kappa Delta extends to all the members of the faculty and the students of the Armour Institute of Technology its best wishes for a successful new year.

## PHI PI PHI

The gay holidays passed and exams approaching, a casual retrospect is not out of order. This recalls, first of all, the pledging of the following men:

J. A. Berchtold
C. L. Carlson
W. W. Fisher
J. A. Rohrer
C. L. Rosenquist
B. A. Shoan
E. W. Short
R. F. Stellar
F. O. Tell
C. Winkler
J. R. Yount

The first social event arranged for these men was a theater party. The next event of interest was the annual pledge dance, at which the above pledges entertained the actives with more than the normal freshmen pep. The dance was held at the chapter house on November 27. Many of the alumni were present, especially those recently graduated, bringing memories of the times when they too performed as pledges.

The week immediately before the holidays saw the initiation of the following men:

E. J. Cremer
J. P. Edstrand
C. E. Gastons
E. C. Jorgenson

The first of the week was dark for them but things gradually brightened, the climax coming in the initiation ceremony on Friday, December 17.

Then came the New Year celebration. All who were in the city brought girl friends and gathered at the house for a party. Those who could play instruments did so, and those who could entertain were called upon. A large superhetrodyne radio added variety to the program.

The chapter extends to you the best of wishes for a happier and better New Year.

## RHO DELTA RHO

Rho Delta Rho fraternity wishes to announce the pledging of the following men:

B. Bernstein
S. P. Cooperman
F. J. Fisher
R. Garbett
L. Gerstel
M. Hartman
M. Meyer
E. L. Michealson
A. Schwartz
L. J. Sifeck
H. N. Yampole

A theatre party was given in behalf of these men. The "Poor Nut" was selected as the play, for we feel it will teach the freshman what not to do.

The Pledge-Alumni smoker was held at the house on the first Friday in November. The Alumni were quite in evidence as they imparted the knowledge gained through years of experience and hard knocks to the interested and unknowing freshmen.

During the past month several of the more recent alumni have visited the house to offer ideas towards making this the greatest year in the history of Rho Delta Rho.

## SIGMA ALPHA MU

Sigma Alpha Mu announces the pledging of the following men:

C. S. Fischman
C. S. Bernstein
L. N. Chamison
R. Bech
A. Kuklin

We are sure that this group is fully capable of carrying on the work of the chapter in future years.

The social season started with a party at Rainbow Garden, under the direction of F. L. Blume, '26. Three days later, Christmas day, we had the honor of attending his wedding. The chapter is very appreciative of his hospitality and joins in wishing him a most pleasant future.

After two weeks of rest, the boys are back, and at work, trying to capture the first place in scholarship, held so long by Sigma Kappa Delta.

It is the wish of Sigma Alpha Mu that the New Year be one of pleasant surprises and prosperity for all our friends.

## TRIANGLE

Since the last issue of the Engineer went to press, many things have happened. In

(*Continued on page 70*)

# ATHLETICS

## *Phi Pi Phi Wins Inter-Fraternity Basketball Cup*

### SWIMMING

The swimming team is practicing under direction of Coach McGillivary at the University of Chicago pool on Tuesday and Thursday nights, although the fellows may go out any night they care to. There are two letter men back this year, Captain L. J. Marhoeffer and M. J. Abramson, together with several others of last year's squad. Like most others, this team needs more men; divers are especially needed. The two Schuler brothers, both letter men, are casting their lot with the track team this year, leaving a few more places open.

The following meets have been scheduled:

Jan. 14, American College of Physical Education at A. C. P. E.

Feb. 7, American College of Physical Education at Armour.

Feb. 16, Y. M. C. A. College at Y. M. C. A.

Meets are being arranged with Crane College, Lewis Institute, Kent College of Law and Loyola University.

### BLANKETS AWARDED TO ATHLETES

At a meeting of the student body held in November, it was decided to award every letter man who had graduated since the organization of the Armour Tech Athletic Association (1923) a black, lettered blanket and in the future all letter men graduating are to receive the same award.

### CROSS COUNTRY

Cross country members travelled to Naperville on October 30, to be beaten by North Central, 34 to 21. Deiwert finished a close second and the rest of the team came along in time to see the football game which followed. Payne came in fifth, R. Schuler and D. Smith tied for eigth and ninth place, and Finlayson placed tenth. That was the first and last meet of the year. Phil Deiwert was elected captain of next year's team.

### BASKETBALL SCHEDULE

Dec. 6, Notre Dame at South Bend.

Dec. 16, Western State Normal at Armour.

Jan. 5, Alumni game.

Jan. 7, Lawrence at Armour.

Jan. 12, Lombard at Armour.

Jan. 14, Augustana at Armour.

Jan. 22, N. I. S. T. C. at DeKalb.

Jan. 26, Lake Forest at Armour.

Feb. 3, St. Mary's at Detroit.

Feb. 4, Detroit University at Detroit.

Feb. 5, Western State Normal at Kalamazoo.

Feb. 11, N. I. S. T. C. at Armour.

Feb. 18, Lake Forest at Lake Forest.

Feb. 25, "Y" College at "Y" College.

Mar. 4, Lombard at Lombard.

These are all the games with out of town schools which Armour will play. Reuter, our manager, promises several more with teams from Chicago schools. With these games included, the schedule will be full of promising games. Let's get behind our team and cheer them on.

### INTER-FRATERNITY BASKETBALL

The inter-fraternity basketball tournament was again won by Phi Pi Phi, giving them possession of the loving cup. This was to be awarded to the first team to win it three times. In the last eight years, this fraternity has finished at the top of the list and has been defeated but very few times. A round-robin was again played this year with five teams in each division. In the second division it was necessary to play several extra games due to a three cornered tie between Theta Xi, Triangle, and Beta Psi. This was settled by Theta Xi defeating Triangle and, on the same day, losing to Phi Pi Phi. A few of the games were forfeited and, in these cases, a score of 2 to 0 is given.

Division results were as follows:

| | |
|---|---|
| DIVISION I | |
| Sigma Kappa Delta | 2 |
| Rho Delta Rho | 9 |
| Sigma Kappa Delta | 18 |
| Kappa Delta Tau | 5 |
| Phi Pi Phi | 51 |
| Rho Delta Rho | 9 |
| Sigma Kappa Delta | 13 |
| Phi Kappa Sigma | 6 |
| Phi Pi Phi | 38 |
| Kappa Delta Tau | 6 |
| Rho Delta Rho | 16 |
| Phi Kappa Sigma | 9 |
| Phi Pi Phi | 24 |
| Sigma Kappa Delta | 14 |
| Kappa Delta Tau | 13 |
| Rho Delta Rho | 10 |
| Phi Pi Phi | 32 |
| Phi Kappa Sigma | 3 |
| DIVISION II | |
| Theta Xi | 18 |
| Triangle | 15 |
| Theta Xi | 19 |
| Sigma Alpha Mu | 2 |
| Triangle | 15 |
| Beta Psi | 14 |
| Theta Xi | 11 |
| Delta Tau Delta | 4 |
| Beta Psi | 17 |
| Sigma Alpha Mu | 12 |
| Triangle | 13 |
| Delta Tau Delta | 8 |
| Beta Psi | 29 |
| Theta Xi | 6 |
| Triangle | 26 |
| Sigma Alpha Mu | 8 |
| Beta Psi | 30 |
| Delta Tau Delta | 14 |

In order to settle the tie, the three leading teams in the second division matched to determine which teams would play together. Theta Xi and Triangle won the toss and Theta Xi defeated Triangle 21 to 18. Phi Pi Phi then defeated Theta Xi, 18 to 8, winning the school championship.

### HONOR "A" SOCIETY

At a meeting held early in December, the Honor A men elected the following officers for the coming year:

*President*.....F. D. PAYNE
*Vice-President*.....W. F. KUFFEL
*Secretary*.....J. C. HARROWER
*Treasurer*.....C. LONG

The society is open to any man who has won a major letter at Armour. Its insignia is a small gold block—A. On this is stamped a star for each letter the man has won. The bottom of the letter is for track letters, the cross-bar for captain letters, the right hand member for basketball, and the left for baseball.

### FRESHMEN

Any man reporting for a team is eligible for a lettered sweater regardless of his residence period at school. He must be scholastically eligible, however. All men reporting for teams are excused from gymnasium work and will receive credit from the coach. We know there is a lot of good material in the freshman class. Why not bring it out? If you know an athlete, urge him to report for some team. We need men and need them badly in every sport in school.

### BOXING AND WRESTLING

The boxing and wrestling teams are working on Monday and Thursday noons in the Armour gymnasium under the direction of Coach Smith. Jimmy Green is captain of the wrestling team and is the only letter man in school. Walt Healy is captain of the boxing team, Cailles being the only letter man on the team.

No schedule has been arranged for these teams but plenty of action is promised by Manager Swanson.

### VARSITY BASKETBALL

The basketball team went to South Bend on December 6 to open the season with Notre Dame. Three regulars were found to be ineligible, and the coach did not come to the game. In spite of this and with the support of only a half-dozen Armour students, the team put up a good fight. At one time during the game the score was 11 to 8, in our favor. The final score, after Notre Dame had used some seventeen men, was Notre Dame 51—Armour 14.

Our first home game was played at "Y" college on December 16 with Kalamazoo Normal. During the first half, our team was played off its feet by the dash of the visitors, the score being 27 to 7. In the second half the fighting engineers came back strong but too late, for the game ended with Tech on the short end of a 32 to 27 total. This game marked the first appearance of several men. Tell, who played the second half as center, put five baskets through as his part of the score. Augustine, forward, made six, the rest of the points being made on free throws. Incidentally, this is where we lost the game as Kalamazoo sunk but twelve baskets and counted enough via the free throw route to cinch the game. Hoffer, a regular guard of last year's squad, also

(*Continued on page 70*)

# SOCIETIES

*Where the Novices Meet the Experienced of the World*

## WESTERN SOCIETY OF ENGINEERS

It has been commonly observed that shoemaker's children are often in dire need of some sort of foot-covering.

If we generalize, and add to it the fact that one who is rather intimately connected with the editing of the ARMOUR ENGINEER, was intrusted with the responsibility of preparing articles advertising the Western Society of Engineers, we may discover why the society in question has not been mentioned on this page for the past two issues.

To go back to the beginning, the following officers were elected to promote the interests of the organization, and multiply to an unprecedented degree, the benefits members might derive therefrom:

*President*.....A. J. SLATALLA
*Vice-President*.....L. K. SAIRS
*Treasurer*.....B. Z. CAILLES
*Corresponding Secretary*.....A. F. ALGIERS
*Recording Secretary*.....W. W. GOTHARD
*Student Representative*.....F. J. CARLIN

Last November 17, a smoker was held with the customary degree of success. Enough of the novelty and pleasant remembrances remain so that the spring smoker is agreeably anticipated. We think that it would be good judgment to again appoint W. A. Morgan master of ceremonies.

Attendance at the general meetings has been good. We have been particularly pleased with the interest shown by the lower-classmen. A continued good showing will undoubtedly reconcile those who have the best interests of the society at heart, to the loss which will be sustained when the senior Civils graduate.

## ARMOUR TECH MUSICAL CLUB

On account of the relatively small number of students that the Musical clubs can choose from, and the difficulties attending the work after school hours, the club has had to be content in the past with appearing before the school at only one concert each year. This year, with superior organization and leadership we have broken away from established tradition and launched out on a program that embraces the giving of three school concerts in the course of the year. Our first concert was in the form of an assembly on December 16 and was called a Christmas concert. We hope that the program and Christmas spirit apoealed sufficiently to the student bod-- so that they will turn out *en masse* at our next concert sometime early in March. We are planning a series of surprising novelties at this affair, including a dance which will follow the concert. There is no reason why a college organization like ours should hide its light under a bushel. We're out to show the world that Armour and music are synonymous.

## GLEE CLUB

There is perhaps no field of music which offers such a splendid chance for development and training as that furnished by a men's choral organization. The human voice is the most expressive medium in the world and lends itself best to adaptation and modulation. There is nothing more appealing to a person's instincts than a perfectly rendered choral number and those composed of men's voices are usually superior to mixed male and female choruses.

The Glee club at Armour, therefore, has a strong background to build upon, and it is not surprising that they are enthusiastically received. Their work in the Christmas concert was especially good, and a number of the faculty and guests present have commented on the fine musical ability and appreciation they showed.

Not a little of the credit is due to Dr. Protheroe. Dr. Protheroe has been associated with numerous organizations for years and is one of the country's finest musicians. Armour is indeed fortunate to have his assistance. He became interested in Armour while leader of the choir of the Central Church whose pastor at that time was Dr. Gunsaulus. He and Dr. Gunsaulus collaborated each year in writing a Christmas carol which was sung first by the Armour Glee club. Since Dr. Gunsaulus' death, Dr. Protheroe has carried on the custom by writing the words and music himself and the carol presented at the last concert was composed by him. He conducted the Glee club for two years prior to 1920 but was forced to give it up. Last year, however, he resumed the directorship and we hope that he will continue as leader many more years.

## ORCHESTRA

Those who heard the concert last month (as almost everyone did) must have descried a very considerable increase in the quality of performance as compared with the past record of the orchestra. The members feel that Mr. Vevurka is the one to whom the credit for the improvement in this organization should go. It is due entirely to his efforts that we have thrown off our old habits and have taken up a new style of music and a new style of playing.

The nearest we approached to the symphonic in that concert was with the production of the Prelude in G, by Rachmaninoff, representing the sombre toning of the great bells of Moscow. While this number was not originally written for orchestra, it is of the type of an instrumental tone poem and lends itself well to orchestration. The leaders hope some day to develop the orchestra into an organization working with nothing but the symphonies and the arrangements of the masters. In that day the visionaries hear the Bells of Moscow once more, this time in the 1812 Overture, perhaps not with the 101 cannon as called for in the original score, but with a brass and tympani section to work up a real climax, nevertheless.

## THE STRESSES AND STRAINS

This new organization, which performed for the first time on December 16, is the outgrowth of a desire in the hearts of a few members of the band and orchestra for a type of music that had not been, nor could have been, rendered by either the band or the orchestra.

The band has as its ideal, Sousa's Band; the orchestra, the Chicago Symphony. The Stress and Strains aspire to the type of music and the style of playing given by Paul Whiteman. This includes, tuneful and peppy arrangement of the classic operas and symphonies, eccentric dance music, and novelty numbers. This playing is of a type that has never been tried in the Institute organizations and it has given cause for much enthusiasm on the part of the students.

Mr. Rezac has agreed to take charge of the musical direction, and seems to have just the personality and training necessary for the success of the organization. The instrumentation is not all that can be desired but time will eliminate this difficulty. If anyone in school knows of an exceptional trombone player, please report him to Rezac.

## FIRE PROTECTION ENGINEERING SOCIETY

The Fire Protection Engineering society has been active since the first week of school. A splendid group of speakers have addressed the meetings. On October 21, Chief Sieferlich of the Chicago Fire Department impressed upon his audience the terrible toll of life and property taken from the American people as a result of carelessness. On November 4, C. A. Rich, Manager of the Underwriters Adjustment Company, delivered an extremely interesting account of the duties and problems of the adjuster. E. R. Cole, '18, on November 18, told the members of the society about the work of the fire insurance broker. On December 2, E. L. Donovan of the arson department of National Board gave an illuminating talk on "Incendary Fires." An account of his experiences in investigating fires of incendary origin would equal in interest the adventures of Sherlock Holmes.

On December 8, a smoker was held at the Theta Xi house. A Fire Protect smoker is always an event to look forward to and this was no exception. To describe the many excellent varieties of entertainment would require too much space; it is sufficient to say that everyone had a genuine good time. Messrs. Parker, Tuttle, and Townley, all prominent men in the insurance field, gave short talks. Mr. Parker and Mr. Townley are honorary members of the society and are well known to Fire Protects as members of the scholarship committee. Mr. Tuttle is Western Manager of the Insurance Company of North America. Last, but not least, came the refreshments. The society is indebted to Messrs. Payne, Castle, and Nelson for a wonderful evening.

The Fire Protection Engineering society now sets itself to the task of making the year 1927 even more interesting.

## AMERICAN INSTITUTE OF CHEMICAL ENGINEERS

The Armour branch of the American Institute of Chemical Engineers has enjoyed several exceptionally good talks by some of the foremost men in the field of chemistry. Such an interest has been shown in what these men have to say that it has been necessary to hold the meetings in Science Hall. A noticeable number of non-Chemicals have also been present which proves beyond a doubt the character of the meetings.

On Thursday, December 2, Dr. W. Lee Lewis, head of the Institute of American Meat Packers, spoke on his researches leading to the discovery of Lewisite, the deadly war gas. His title was "An Organic Chemist at Work."

Dr. E. H. Volwiler, one of the foremost drug experts in the country, on Thursday, December 16, told the group about the

(Continued on page 70)

# ENGINEERING NEWS

## THE LARGEST LOCOMOTIVES IN THE WORLD

### Progress in Locomotive Design to Fill Particular Needs

The Baltimore and Ohio Railroad is now using the largest passenger locomotives in the world to rush the through trains over the heavy grades in the Blue Ridge Mountains. The present design mountain type locomotive, which has been designated as the "Lord Baltimore," is the result of over one hundred years' experience in mountain traffic, and embodies all the latest features of locomotive engineering.

Some idea of the size of this new giant can be secured by comparing it with No. 1400, built before 1900, and which is by no means an antique, being in itself a standard eight-wheel type passenger locomotive. The weight of No. 1400, without the tender, is 111,000 pounds, with a total weight of 201,400 pounds. Its rated tractive power was 19,800 pounds; contained 1,500 square feet of heating surface, and was fitted with 20-inch by 24-inch cylinders.

Larger and larger types have been introduced to take care of the larger trains and faster schedules, with No. 5500 (Lord Baltimore) the largest developed, for passenger traffic, to date. American practice in locomotive design employs boilers of very large capacity so that the cylinders are always assured of a plentiful supply of steam. In No. 1400 the boiler diameter was 62 inches, carrying steam at 180 pounds pressure. No. 5500 has a 100 inch boiler carrying steam at 220 pounds, and has a total heating surface of almost 6,900 square feet. Other dimensions have increased accordingly: the cylinders being enlarged from 20 inches by 24 inches to 30 inches by 30 inches, the rated tractive power jumping from 19,800 pounds to 65,000 pounds, and the weight of the engine alone from 110,000 pounds to 400,000 pounds. The length of No. 5500 is 100 feet; the weight, including the tender, is 659,000 pounds; it develops 4,960 horsepower at a speed of 50 miles per hour, and is capable of hauling a 12-car all-steel train 70 miles per hour over the steep mountain grades encountered in the Cumberland foothills. The picture on the cover shows No. 5500 in action.

The following table gives some comparative dimensions of the two locomotives:

| | No. 1400 (1895) | No. 5500 (1926) |
|---|---|---|
| Cylinders | 20 in. x 24 in. | 30 in. x 30 in. |
| Valves | Slide | Piston |
| Clearance height | 14 ft. 5½ in. | 15 ft. 5½ in. |
| Clearance width | 8 ft. 10 in. | 10 ft. 8 in. |
| Length | 38 ft. 8 in. | 100 ft. 6 in. |
| Driving journals | 8 in. x 8½ in. | 11 in. x 13 in. |
| Boiler diameter | 62 in. | 100 in. |
| Tubes, No. and diam. | 194-2¼ in. | 269-2¼ in. |
| Tubes, length | 11 ft. 6½ in. | 23 ft. |
| Total heating surface | 1,500 sq. ft. | 6,896 sq. ft. |
| Tender, coal capacity | 8 tons | 18 tons. |
| Rated tractive power | 19,800 lbs. | 65,000 lbs. |

The Virginian Railway boasts the largest steam locomotive in the world. It seems highly probable that the limit in size has been reached for any single unit, since the expense of maintaining such large Mallet engines is very high. The many losses and expenses incident to steam operation are magnified in such intense and heavy service, making the economy low, although the efficiency is high.

The Virginian is strictly a freight road—built specifically for moving coal from the rich New River and Pocahontas fields to tidewater at Norfolk. From the very beginning the road has been confronted with severe engineering problems—long, heavy trains, steep grades, and heavy rolling stock. In spite of this it has managed to operate at very high efficiency due to investment in modern equipment, the progress in size keeping pace with the increasing tonnage of coal handled. The powerful Mallet type locomotives were first introduced in 1907. These could exert tractive efforts of 70,800 pounds, which is large even for 1927. Eight more followed of 90,000 pounds tractive power, the next step being 100,800 pounds, and this has lately been followed by six new engines capable of exerting a tractive force of 115,000 pounds. The weight of this latter alone, without the tender, is 684,000 pounds.

The engine is a compound Mallet of the 2-10-10-2 type. This means that on each side there is a single wheel followed by two sets of 5 drivers, each set coupled together, and brought up by a single small wheel immediately under the cab. The steam, at 215 pounds boiler pressure, is first admitted into the high pressure cylinders, mounted on the main engine frame at about the mid-length of the boiler. These cylinders are 30 inches by 32 inches. The low-pressure cylinders, 48 inches in diameter with a stroke of 32 inches, are mounted on a special truck, free to turn of itself, on which are also mounted the forward ten drivers. This independent mounting is necessary when the locomotive

#### THE COVER

*Attention is called to the fact that the cover design is a drawing of the world's largest passenger locomotive, the Lord Baltimore. It is our desire to make our cover design illustrative as well as decorative. In carrying out this purpose, the accompanying article brings out some of the features of this giant of the rails.*

*To fully appreciate the significance of this engineering accomplishment, consider what it originated in.*

*The first locomotive in the world was built by Richard Trevithick in December, 1803, and was tried on the Merthyr Tydvil Tramway, South Wales, February 24, 1804, a distance of nine miles.*

*The first locomotive in America was The English Stourbridge Lion, which arrived in America, May 17, 1829, on the sailing vessel John Jay. The first locomotive built in America was Peter Cooper's Tom Thumb (so-called because of its diminutive size), which was tried out in September, 1829.*

*It is of interest to compare the Tom Thumb with The Lord Baltimore, the largest mountain type passenger locomotive in the world.*

*The Tom Thumb—Length, 13 feet, 3 inches; weight, one ton; developed 7½ horsepower at a speed of 10 miles per hour; average speed hauling one small car, 12 miles per hour.*

*The Lord Baltimore—Length, 100 feet; weight, including tender, 659,000 pounds; develops 4,960 horsepower at a speed of 50 miles per hour; capable of hauling a 12-car all-steel train 70 miles per hour.*

*Such is a century of progress in locomotive engineering.*

*Photo, courtesy of Baltimore and Ohio R. R.*

An interesting contrast between the new type No. 5500 and No. 1400. The smaller engine was built in 1890, and the comparison strikingly shows the development of the modern passenger locomotive.

rounds a curve. The tender carries 13,000 gallons of water, and 13 tons of coal, which is consumed in two hours—fed to the furnace continuously by a mechanical stoker.

This type of compound Mallet freight engine is probably the ultimate in size, for the Virginian Railway is now turning its attention to mammoth electric locomotives. Substantial economies have been effected by electrifying between Mullens and Roanoke. The electric locomotives supplied thus far have been of a semi-permanently coupled design, enabling three of these smaller units to be coupled together and operated as a single power unit, controlled from the forward cab. Each cab has the Mikado or 2-8-2 wheel arrangement, the weight per cab being 428,000 pounds, making the complete weight of the unit about 638 tons.

The maximum tractive effort of each cab is 92,500 pounds. At the conservative starting adhesion of 25 per cent, the tractive effort is about 77,000 pounds per unit, or 231,000 pounds for the three unit road locomotive. This is 57 per cent greater than the compound rating of the single 2-10-10-2 steam engine. The 6,000 horsepower that it exerts continuously is considerably larger than that possible by any steam locomotive in existence.

The Illinois Central has recently developed its motive power by ordering fifty of a new type 2-8-4 freight locomotive from the Lima Locomotive Works, Inc. Among the new features that make for efficiency and economical operation may be mentioned the four-wheel articulated trailing truck enabling a much larger firebox with its attendant huge grate area, and the booster, attached to the second pair of wheels on this truck, which is an auxiliary engine and serves to assist the main cylinders in starting a heavy load or on upgrades. The 12-wheel tender with its huge water and coal capacity is another change in locomotive design. Feedwater heaters of the Elesco and Worthington type are installed in front of the stack.

The steam pressure is higher than ordinarily used—240 pounds per square inch. The cylinders are 28 by 30 inches. They operate at 60 per cent cut off as compared with about 85 per cent in the previous Central type locomotive. The tractive effort of the main cylinders is 69,400 pounds, and 84,400 pounds when the booster is working. The booster is intended merely as a starting aid, and cannot be used in conjunction with the main cylinders at speeds exceeding 20 miles per hour. The total length of engine and tender is 95 feet 11 inches. The weight of the engine is 388,000 pounds, the total weight of the engine and tender being 674,000 pounds. The total evaporative heating surface is 5,164 square feet, while the superheater has 2,111 square feet of heating surface. The huge tender is designed to carry 15,000 gallons of water and 20 tons of coal.

## NAVY INSTALLS EIGHTY-KILOWATT STATION

A radio transmitter rated with an output of 80,000 watts, said to be the largest vacuum tube installation in the world, has been put into operation at the naval radio station at San Diego, California, according to an announcement by the radio division of the Navy department. The equipment was designed for radio-telegraph communication, and messages may be sent at the rate of 100 words a minute.

The transmitter at San Diego is about four times as powerful as any other vacuum tube set used by the Federal Government, according to the Navy's radio engineers. It is capable of radiating about eighty times as much electric energy as the ordinary radiophone broadcasting station using 1000 watts. With this modern installation the Navy Department will be able to communicate directly with NSS, Annapolis, Maryland, with the Hawaiian Islands, with Japan and with the battle fleet, no matter where it is cruising on the Pacific.

## "TRIPLEX" SAFETY GLASS

The production of safety glass of various types has been attempted in the United States. Its drawbacks to date have been either that it had reinforcing wires that do not favor clear vision, or that it took on a yellow tinge with time, which had an obscuring effect.

Triplex safety glass is new only in the United States. It has been made and widely used in England since 1914. It has absolutely clear vision with no discoloration.

Actually, it is two sheets of the finest plate glass, with a middle layer of pyralin. The three layers are pressed together under heat, and at a pressure of 1,500 pound per square inch. Due to this enormous pressure, the plate glass will crack and be destroyed in manufacture if it has the slightest irregularity on the surface. Hence the makers go to Czecho-Slovakia for the best plate glass obtainable. Preparations are now under way, however, to make such glass in the United States.

Under a very heavy blow, this glass gives way, but does not shatter or splinter. Consequently it cannot cut anyone. Three-quarters of the injuries in auto accidents come from flying glass; and jewelry store thieves thrive on common plate glass windows. In these two fields lie the most obvious uses for this safety glass. It is also widely used for eye-protection in industry, on common carriers such as subways and buses in England, on airplanes, etc. It cannot be cut with a diamond. It was triplex which Mussolini ordered for his cars after one of the recent bomb attacks.

## LIQUID OXYGEN EYPLOSIVE

Liquid oxygen explosive, or "LOX," as it has come to be known, is made by mixing very finely divided carbon, which is in the form of lampblack, with the liquid oxygen. The association of the carbon and the oxygen is so intimate that when combustion is started by a fuse or detonator, the carbon instantaneously burns and creates a large volume of highly heated carbon dioxide.

At the moment of combustion, or explosion, the temperature of liquid oxygen jumps from —269.5 F. to +5,600° F., a range of 5869.5 degrees. The shattering force of this combustion is sufficient to rend asunder huge strata of rock.

The practicability of liquid oxygen as an explosive has been put to test by the United States Bureau of Mines. It has been found particularly advantageous for blasting rock in quarries or in other open rock formations. During the war, when the Germans ran short of glycerine and Chilean nitrates, they found it imperative to evolve a substitute for dynamite as an explosive. The engineers, who had been working for years on the process of liquefying oxygen, put it into use as an explosive in underground mines.

In the last few years, liquid oxygen has been used in quarrying in New York, Pennsylvania, Colorado and other states, with significant results as compared to the use of dynamite. In one conspicuous experiment which was recently made by the Air Reduction Company and the Ingersoll-Rand Company sixty cartridges of liquid oxygen were placed in twelve holes, twenty-eight feet deep and six inches in diameter. A single trunk fuse was used to set off all the cartridges simultaneously. The drill holes were set twelve feet apart, in a thirty foot rock bench.

The cartridges, fitting snugly, were 18 inches long and 5½ inches in diameter, five being placed in each hole. They were encased in bags made of stout muslin and filled with finely divided carbonaceous material of a highly absorbent nature.

Out of 1,014 pounds of liquid oxygen into which the cartridges were dipped, each one absorbed about fifteen pounds, or 940 pounds for all. Since the cartridges were immersed in relays, one hour and a half elapsed from the time they were dipped until they were placed in the drill holes. This fact is pointed out by engineers as emphasizing that, even with a relatively rapid evaporation of liquid oxygen, sufficient time may be taken for delibrate placing of the cartridges, so as to obtain the most effective results.

The safety of blasting with LOX is one of its characteristics, recognized officially by the Bureau of Mines. Its cartridges cannot be set off except by a very severe shock. The Bureau of Mines says of it: "No danger exists in the transportation of this explosive to the point of use. Practically no danger exists of premature explosion. Danger of misfire in case a cartridge is not properly exploded is eliminated by waiting a sufficient time to allow for the evaporation of the oxygen. The time necessary for this depends upon the diameter of the cartridge.

"An unexploded stick of dynamite is always a menace if encountered while mucking or during the removal of coal or ore from a mine, but the liquid oxygen cartridge, under similar conditions, is 'dead'."

In Europe there are many plants producing liquid oxygen. One mining company, in Lorraine, is mining its entire output of iron ore by liquid oxygen explosive, and it is estimated that fully 80 per cent of the iron ore mined in France is being blasted with LOX. New liquid oxygen plants are now being built in this country.

## A NEW VACUUM SWITCH

The first invention to be worked out and perfected in the million-volt laboratory of the California Institute of Technology at Pasadena, California, is a vacuum switch, the product of the work of Prof. Royal W. Sorenson, aided in his experiments by Dr. Robert A. Millikan.

The invention is designed to take the place of costly and ponderous oil-immersion switches that have been used in large power plants to cut off heavy currents of electricity on short notice. The principle on which it works is based on the well attested fact that electricity will not travel through a perfect vacuum. A terrific arc results when a high tension current—say of 100,000 horsepower—is cut off in the open air. Some protective device is necessary. Heretofore, extremely large, expensive oil-immersion switches have been installed in all large power plants to quench these arcs in time of emergency. In the splendidly equipped laboratory of the Institute, Professor Sorenson has been able to establish a virtual vacuum within a small glass bulb which serves as a cut-off switch.

"We have fully established the theory, and all our tests have been successful," he explains. "We have handled a circuit up to 1,000 amperes at 40,000 volts safely and without any difficulty whatsoever. Probably

(Continued on page 76)

# HUMOR

## *A Hearty Laugh Doeth Good Like a Medicine*

### Help

Prof. (in medical school examining future doctor): If you found a man with a big gash in his head that was bleeding freely, what would you do?

Reply: I'd put a tourniquet on his neck.

—*Rice Bowl.*

---

Little boy (sight-seeing in Washington): "Hey, poppa, when are we going to see the red tape, huh, poppa?"

---

"I've been reading statistics—every time I breathe a man dies."

"Gosh, man! Why don't you use Listerine?"

—*Printer's Devil.*

---

Correct this sentence:

Prof.: As I hand you your papers, pass out.

---

### It Might Get Serious

"Why have they postponed hanging McGinty?"

"He has a boil on his neck. . ."

"Yeah."

"And they're afraid the chafing of the rope might cause infection to set in."

---

### Even as You and I

She—"Do you think you could learn to love me?"

Bashful—"I might, I passed Calculus."

---

### Nothing to Worry About

Had a big scare last night. Woke up and saw someone going through my coat pockets. Quickly I drew my shotgun from beneath my pillow and poured both barrels at the marauder, but the joke was on me, it was only Kate.

---

Deadeye—"You say Joe got killed? How come?"

Dick—"Well, he stuck his head in that saloon and hollered fire."

"Then what?"

"They did."

—*Amherst Lord Jeff.*

---

Customer—You say this hair restorer is very good, do you?

Druggist—Yes, sir; I know a man who took the cork out of a bottle of this stuff with his teeth, and next day he had a mustache.

—*Bucknell Bell Hop.*

---

Husband: "Knowest thou how to bringge uppe thy childe?"

Wife: "Certainllie, sluggarde."

Husband: "Then snappe to. Thy childe is at the bottomme of ye cisterne."

—*Hamilton Royal Gaboon.*

---

1st Prof.—I call my eight o'clock French quiz, the Pullman class—three sleepers and an observation section.

2nd Prof.—Very apt. I call my nine o'clock Cicero the pony express.

—*Nebraska Awgwan.*

### BEDTIME STORY FOR ENGINEERS

In the valley of Calculus, close by the river of Arsenic, lived a little slide-rule, by the name of Log-Log. Little Log-Log went out hunting for integrals one day, armed with his trusty double-barreled Lefax. After looking for tracks for a long time, between the limits of zero and raspberry pi, he suddenly came upon a wild integral feeding on a dyne bush. The ferocious integral became enraged at the interruption and charged at poor little Log-Log. As he came thundering through the dense underbrush (density is inversely proportional to the square of the distance from negative infinity) he roared and growled his battle cry of "Heterodyne your signals to one frequency." Little Log-Log stood ready with his Lefax, and was prepared to use his self-spilling, fountain pen in case of a hand to hand struggle. As the charging integral came within ten millimeters of where little Log-Log stood, Log-Log pulled all 27 triggers and fired into the integral's third quadrant. The enormous power of the Lefax which was heavily charged with trigonometric and logarithmic tables, spun the integral about his y-axis and sent his moment of enertia flying along a sine curve into the fourth dimension. Little Log-Log restored his trusty Lefax to his brief case and oscillated along the path to his home, dragging the inert integral by his polar coordinates. When he arrived home, his supper of broiled ohms and ionized ampere soup was waiting for him. Now, if you are all good little engineers maybe Uncle N. G. Neer will tell you some more of the adventures of the little Log-Log.

---

Mrs. Cox (handing saucer full of white powder to her husband): "John, taste that and tell me what you think it is."

Mr. Cox: "It tastes like soda."

Mrs. Cox: "That's what I told Bridget. She declares it is rat poison. Taste it again and make sure."

—*Kansas Engineer.*

---

Hey, that election was crooked.

How come?

Why, I went into the voting booth, saw Jim, Ray, Dick and Louis stuffing the ballot box.

When did you see that?

The third time I went in to vote.

---

Your knees must be going some place.

Why?

Well, they have their caps on.

---

Student: Say, Doc., what's this bill for?

Doc.: Five dollars—two dollars per call for two calls and one dollar for medicine.

Student: Alright, Doc., here's the dollar, I'll pay back the calls.

---

Tramp—Lady, is you got any old clothes?

Lady—No; how did these get so ragged?

Tramp—I'm a public hero and de folks wore 'em out pinin' medals on me.

—*Okla. Whirlwind.*

---

Lady—"Get out of here before I give you a piece of my mind."

Tramp—"Don't do that, lady. Save the pieces and maybe you can have the darned thing fixed."

Jones—Sorry, old man, my hen got loose and scratched up your garden.

Smith—That's all right; my dog at your hen.

Jones—Fine. I just ran over your dog and killed him.

—*Witt.*

---

She: "I believe every person should sing at his work."

He: "My brother can't."

She: "Why not?"

He: "He's a trombone player."

---

The new night watchman at the Observatory was watching someone using the big telescope. Just then a star fell.

"Begorra," he said to himself, "that fella sure is a crack shot."

—*Michigan Technic.*

---

Grad: "What salary do you think I'm getting?"

Undergrad.: "Ah, about half."

Grad.: "Half of what?"

Undergrad.: "What you say."

—*Rose Technic.*

---

"Did your last employer give you a reference?"

"Yes, but it doesn't seem to do much good."

"What does it say?"

"He said I was one of the best men his firm had ever turned out."

---

"Mother, what is that tramp doing with that piece of wrapping paper?"

"Hush, child, that is a college graduate with his diploma."

---

Northerner: "Pretty mild winters you have down here."

Southerner: "Mild! Do you call two feet of snow mild?"

Northerner: "Two feet! Say, man; the snow was so deep in our country last winter that the farmers had to jack up their cows to milk them."

---

First Scot: "Why are you taking the paper off the wall, Jock?"

Second Scot: "I'm moving tomorrow."

---

Foreman: "Are you a mechanic?"

Pat: "No, sor, I'm a McCarthy."

—*Minnesota Technology.*

---

The meanest man we know is the warden who put a tack in the electric chair.

—*Arizona Kitty Kat.*

---

It was in the middle of the night; suddenly the floor creaked mysteriously. The frosh started up in bed. "W-what's that noise?"

"Aw, it's just the house settling down for the night," grunted his roommate.

—*Wash. Cougar's Paw.*

---

Or it might be—

"Heff you any eggs?"

"Yes, ve heff eggs."

"Heff you any hem?"

"Yes, ve heff hem."

"I'll heff hem und eggs."

—*Studebaker.*

## FRATERNITIES

(Continued from page 64)

the first place, Triangle has the pleasure of introducing to you the following freshmen as pledges to our fraternity.

W. S. Chandler
J. B. Garth
W. L. Hafner
R. B. Johnston
F. A. Schoneman
R. M. Spencer
M. G. Whitfield
R. H. Windeigler
T. A. Woods

Of course, the rushing season was the main item of interest after school opened. The program was in capable hands, however, and dances followed theater parties and smokers jogged along after dinners without a bit of trouble. Triangle always has good dances, but the one that came during rushing season was especially fine. Brother George Petters furnished one of the best dance orchestras ever heard.

Triangle came through last semester with a scholastic average of eighty-eight. This makes us first on the list of national fraternities, the Sigma Kaps having managed to nose us out of first place in the all-fraternity group by just a small amount.

## BETA PSI

Beta chapter of Beta Psi held a Christmas party at the fraternity house, 3337 South Michigan Avenue, on Friday, December 17, 1926. A four piece orchestra furnished the music for the dancing.

At a recent initiation H. Fabian and M. Johnson were initiated into the brotherhood of Beta Psi.

The following men have been pledged to this fraternity during the last semester:

R. B. Fasick
A. C. Haegele
R. E. Johnson
T. H. Johnson
N. B. Lind
J. W. Manz
O. C. Marek
A. C. Reglein
A. L. Scully
R. B. Swanson
R. O. Van Osdol
C. J. Wittgren

With the accomplishment of providing a home for the fraternity as a background, we feel satisfied in looking forward to a happy and prosperous New Year.

## KAPPA DELTA TAU

Kappa Delta Tau wishes to announce the pledging of the following men:

M. Broude
J. E. Ellman
S. P. Garfinkle
W. Olefsky
H. Stein

In keeping with our usual custom of bringing the alumni and freshmen in contact, numerous smokers have been held at the house.

## SCARAB

Looking back upon the year that has just passed on into history the Edfou Temple of Scarab may feel that our efforts have been successful in more ways than one. Last year this temple carried away a large portion of the honors which are awarded each year to the work in the traveling exhibition. We are now looking forward with high hopes to the coming exhibit.

The bi-weekly luncheons have met with much success. It might be well to explain to those who are not Scarabs, that it is through the medium of these get-to-gethers that the fellows in school maintain a contact with the men who have graduated and are now actively engaged in the practical application of Architecture.

It is with great pleasure that we announce the pledging of the following men:

I. H. Bowman
E. J. Higgins
T. E. Samuelson

The officers for this year are as follows:

*President*.....N. D. Barfield
*Secretary*.....E. B. Knickerbocker
*Treasurer*.....I. P. Halama
*Corresponding Secretary*.....C. T. St. Clair

## SOCIETIES

(Continued from page 66)

"Chemical Side of Medicinals." Dr. Volwiler is from the Abbott Laboratories, of this city.

January 20 will be the first meeting of the new year. Mr. D. K. French will speak on "The Practical Application of Water Treatment."

Dr. W. D. Harkins, of the University of Chicago, will be with us sometime in February, when he will tell us about some of his work on isotopes and atomic structure in a way that everyone can understand.

## AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS

The first meeting of the student branch of the American Institute of Electrical Engineers was held on November 4. Mr. A. C. Flenner, '27, spoke on the subject of "Stage Lighting." His talk was very interesting and we hope to hear from him again. On November 18, Mr. C. E. Tweedle, '25, spoke on "The Place of the Engineer in Foreign Trade." The third meeting was held on December 2, jointly with the W. S. E. and the A. S. M. E. Mr. Morrow, President of the W. S. E. and Chief Engineer for the C. and W. I. Railroad, spoke on "Terminal Unification." On December 16, Messrs. E. H. Madden and G. E. Coole took the floor with a discussion of the history of electricity. Several extra chairs were required to accommodate the crowd.

A smoker was held at the Theta Xi house on the evening of November 17 with a splendid attendance. The entertainment committee with Frank Pischke as chairman furnished an excellent program.

The student branches of this organization are being grouped together into sections in a manner similar to that of the parent organization. The Great Lakes section will include:

Armour Institute of Technology
Purdue University
Michigan State College
University of Michigan
Lewis Institute
University of Minnesota
University of Wisconsin
University of Illinois

The purpose of grouping in this way is to facilitate the procuring of good speakers. In addition, frequent banquets and meetings will bring the students in direct contact with practicing engineers. To further this a banquet was held on December 15, at the Palmer House. Armour was well represented.

## ATHLETICS

(Continued from page 68)

saw quite a bit of action in his old position.

The starting lineup was.

| Armour | | Notre Dame |
|---|---|---|
| Tavilinsky | R. F. | Bray |
| Fabian | L. F. | Coleric |
| Brumund | C. | Nykos |
| Kuffel | R. G. | Beston |
| Augustine | L. G. | Conroy |

Later in the game Simpson, Reifler, Manz, and Egan also played. Considering the time the team has had to get into shape, they made a very fine showing.

## GOLF

The fall golf tournament was not finished but is to be played off in the spring. Three men are still left, Christianson, Jennings, and Quinby. From the scores and performances reported, it looks as though Christianson will finally emerge the victor. There were about twenty men entered in the matches.

## TRACK

The track team has been working at the University of Chicago gymnasium, under the direction of Lony Stagg since the first part of December. Last year, we had the use of their gym but, with actual coaching under Lony, a decided improvement should result. There are ten letter men back in school and most of these have reported for work. It is planned to hold a few indoor meets this year. As usual the team will attend the Illinois Relay Carnival at Urbana on February 25-26. It is probable that some of the team will enter the I. A. C. Handicap Meet on January 28, here in the city. Other meets are to be arranged later.

## THE ARMOUR ALUMNUS

### Alumni News

(Continued from page 30)

William D. Otter, '10, was in to say "Hello" last month. He is now Manager of the Western District of the Bradford Corporation, with offices in the Rialto Building, San Francisco, California.

Those who recall the basketball flash and baseball captain of teams at Armour in the years 1921-1923 may be interested in knowing that Gerhard (Gerry) Schumacher, '23, is an engineer for the Hartford Fire Insurance Company, 814 Merchants Bank Building, Indianapolis, Ind. Probably of greater interest, however, to those of his friends now out of touch with him would be the announcement that he has taken unto himself a wife and is living at 3720 North Pennsylvania Street, Apt. 20, Indianapolis, Ind. Chicago girls can not feel proud of their beauty any longer because "Handsome Gerry" went to Indianapolis to find his wife.

Carroll Harry Roberts, '19, stopped off in Chicago in the middle of September on his way to Menomonie, Wisconsin, where on September 18, he was to play one of the minor rolls in the nuptials of Harold Gillette Ingraham, '17. Roberts and Ingraham had been roommates the short time they were attending college together. Of course, while in Chicago, Roberts came out to the Institute to look things over and remarked that it was his first visit since he had left the classroom for the Officer's Training Camp at Fort Sheridan during the War. He is an insurance broker of the Roberts Insurance Agency, P. O. Box 975, Beaumont, Texas. Because we did not get an announcement of Ingraham's wedding, we regret that we can not divulge the identity of the co-star in his little one-act play other than today she is Mrs. Ingraham. He had just previously returned north from Florida and because of the nature of his venture, we take it he was successful there. He is now with the Simmons Company.

Edwin B. Crane, '09, is now assistant engineer with the Pennsylvania-Ohio Light Company, Youngstown, Ohio.

# A sermon in stones

CECIL RHODES, the diamond king, had a real idea which he passed on to diamonds in the rough.

"Be well-rounded men, broad in your sympathies," he said, and he made this the basis for selection of Rhodes scholars.

Surely there's a lesson for every man—graduates alike in arts, in pure science or in applied science—to balance the student in him with the athlete, the individualist with the man of sociability, the specialist with the "citizen of the world."

For Rhodes' idea was no theory. It is shared by hard-headed business men today.

*Published for the Communication Industry by*

**Western Electric Company**

Makers of the Nation's Telephones

*Number 64 of a Series*

## CONCRETE BRICKS

(Continued from page 53)

mixer with aggregate and cement and dry-mixes for two minutes. Then water is added and the batch is wet-mixed for two minutes, when it is dumped. The concrete mixture may seem dry, but it is amply wet, for it is of the consistency insuring maximum strength.

When the concrete is dumped, it falls into a small hopper, from which a small drag elevator picks it up and elevates and dumps it into a hopper directly above the brick machine. From this hopper it is fed into the cavities of the brick machine and tamped by automatic power tampers.

A self-spacing wooden pallet is used in the brick machine to make the bricks on. As the bricks are manufactured, these pallets, which carry ten bricks, are taken out of the machine and stacked up. The pallets are termed "self-spacing," as two blocks, a little larger than the bricks, are placed under either end, and thus, as the pallets with bricks upon them are piled up, they are so spaced by these blocks as to prevent the top pallet from resting upon the bricks.

As the bricks are made and taken from the machine they are stacked ten pallets high. The machines make a brick two and three-eighths inches, by three and seven-eighths inches, by eight and one-quarter inches in size. Ten bricks are made at one time. Thus, a stack of pallets ten high holds one hundred bricks. A truck picks up these stacks of bricks, and a man runs them into the curing room. This truck is especially designed, with two wheels having rubber cushion tires on them. The truck goes under the bottom pallet, picking up the stack easily and without jarring it. By means of this truck the bricks are in no way disturbed in obtaining their initial set. The bricks are carried into the curing rooms in this manner and, when properly cured are carried to the storage yard.

The curing of the bricks is done in four curing rooms, each curing room handling fifteen thousand bricks. If warm, foggy weather predominated, curing rooms would not have to be used, for such days are ideal for curing, but in as much as this kind of weather rarely occurs, it is necessary to manufacture such weather conditions.

The curing rooms are built of concrete bricks. The roof is made of concrete and is of a slant roof design. This type of roof is necessary so that, as the moisture in the curing rooms condenses, it will run down the slanting slope of the roof to the side walls and then down to the floor, without danger of dropping from the roof on the brick, thus injuring the surface of the bricks while they are being cured.

Both heat and moisture for the steam curing system are obtained by discharging steam at low pressure (not over five pounds) directly into the curing rooms. A steam main runs along the floor of the curing room for its full length and the steam is discharged through small openings not more than one-eighth inch in diameter, located at intervals of one foot along the pipe line. A trough is provided on the curing room floor for drainage. The temperature in the curing rooms is kept at about one hundred ten degrees F. This is about the most desirable temperature to maintain, since it cures the brick to the best advantage. The brick are cured for a period of thirty-six to forty-eight hours.

After the bricks are cured, they are carried to the storage yard, removed from the pallets and stacked in piles.

Frequent laboratory tests constitute the only means by which the quality of brick can be known with certainty. The specifications of the American Concrete Institute and American Society of Testing Materials are the standards by which the quality of the brick are judged.

A complete report on the "Comparative tests of clay, sand-lime, and concrete-brick masonry," may be found in Bulletin No. 2, Department of Civil Engineering, Columbia University. One may also be found in Bulletin P-111, of the Portland Cement Association of Chicago.

## PINE OIL

(Continued from page 58)

Where a light colored product is desired, cotton seed oil or some other fat is used as the soap base. For ordinary purposes rosin is used exclusively. Such a preparation will milk up in water and combines the detergent properties of soap with the grease and oil solvent properties of pine oil.

The preparation should be used in small quantities only and is equally useful in wet washing and in dry cleaning.

This product is also being extensively used in treating cotton preparatory to dyeing.

Pine oil contains about 65 per cent of terpineol, and about 5 per cent of borneol. These products can be isolated by careful fractionation, preferably by vacuum distillation. In this manner terpineol of such purity can be obtained that it will crystallize in a freezing mixture.

Terpineol finds extensive use in the perfume industries and its value as a carrier in soap perfuming is well known and utilized.

Borneol finds application in incenses and as a raw material for the production of camphor. This conversion is accomplished by a simple process of oxidation.

Terpin hydrate finds extensive use as a U.S.P. product in the drug trade. Formerly, terpin hydrate was made from turpentine by a tedious process. It is much more readily recovered by treating terpineol, made from pine oil.

By a simple acid treatment the terpineol of pine oil is converted into the terpenes, dipentene and limonene. In solvent properties and volatility these terpenes stand between turpentine and pine oil, and are consequently specially suited in various applications. Such a solvent is being commercially made by the various turpentine plants and is marketed under various trade names.

The above are the chief uses of pine oil. It is, however, found useful in many applications too numerous to mention.

New uses are continually coming up and as the demand for this new product will increase and its production will become limited, its use will ultimately be directed into the most specialized and profitable channels.

## WHAT PRICE KNOCK

(Continued from page 55)

are of greater value. A closer inspection of the data in Tables No. 2 and 3 shows that the relative values of raw gasolines which are to be blended with benzol for specific anti-knock qualities depend on the condition of blending. The particular gasoline which requires ten per cent or less of benzol is apparently handicapped or in other words, the first ten per cent is relatively less effective than additional ten per cent increments.

In Table No. 4 the price of blended fuel has been computed from the computed values of raw gasolines A, B and C as determined in Table No. 2. Under the assumed conditions, for instance, gasoline C is worth 18 cents a gallon for a 26 anti-knock index value and only 17.6 cents per gallon when blended for a 32-Index value. This represents an apparent decrease in value which is not true of gasolines B and A. The apparent inconsistency is due to the characteristic effects obtained from benzol blends by this method of testing. The first ten per cent of benzol gives a smaller increase in index value than does additional ten per cent increments of benzol. This characteristic is also influenced by the fact which has been pointed out in N.A.C.A. Report No. 232, page 19, by Stanwood W. Sparrow, that the first ten per cent must act with 90 per cent of raw gasoline, but the 30 or 40 per cent act only with 70 or 60 per cent of the raw fuel, respectively.

# Refrigeration Engineers Prefer *Armour's* *Anhydrous Ammonia*

ARMOUR'S Anhydrous Ammonia is made from aqua-ammonia, a by-product of the coking industry, and is guaranteed to be absolutely pure, dry and volatile—absolutely free from foreign substances. It is economical because its purity assures the removal of all possible heat units at a minimum operating expense. Every cylinder is tested before shipment, and is shipped subject to your evaporation test before using.

For these reasons, leading authorities have held Armour's Anhydrous Ammonia to be the most efficient as well as the most practical medium for refrigeration purposes.

Skill, long experience and superior equipment combine to give it a quality that is not excelled. Fifty pound, one hundred, and one hundred and fifty pound cylinders are carried in stock at all principal shipping points.

*Write for Full Particulars*

ARMOUR AMMONIA WORKS

*Owned and Operated By*

**ARMOUR AND COMPANY**

CHICAGO

## A GREAT RELIGION

(Continued from page 50)

fifty years (B.C. 256-205) but during this period feudalism was abolished, and a strong central government was established which lasted till 1911. The Great Wall of China was built during this period; in fact, the very name "China" comes from the name of this dynasty, the Chin.

In the midst of the unsettled feudal period, Confucius was born in the small country of Loo. His father, an eminent statesman, was a man of seventy when he married a young woman who soon became the mother of the sage. When Confucius was but three years old, his father died. The boy was fond of study and at the age of fifteen had mastered the Sacred Books or "Kings" of China. Confucius was married at the age of nineteen and had one son. His married life was not much of a success for he soon left his wife and we hear little more of her. His son became one of his disciples but died at an early age leaving one grandson. Confucius held various state offices, travelling about the country, until at the age of fifty he became a magistrate in his native state and finally what we would call the minister of justice. Here he applied many of his theories of government to test their practicability. His success was soon apparent for in place of the old tyranny he substituted a rule of love—the rule of the father of a family. Under his guidance the state prospered with the result that Loo rose to a position of commanding importance among the states. The completeness of Confucius' success was the cause of his downfall for the prince of a neighboring state, envious of the progress of Loo, devised a plan to curb its advance. He sent the prince of Loo a present of some magnificent racing horses and a bevy of beautiful dancing girls. It was too much for the prince of Loo. He dismissed Confucius with his austere virtue and gave himself to pleasure and indulgence.

Confucius was convinced that his experiment in Loo was a success and spent the next twelve years of his life wandering about the country, trying to induce one prince after another to accept his ideas and try his theories. He was unsuccessful and finally returned to his native country where he spent the closing days of his life editing the classical literature (the Kings) of the country. There, in the year 478 B.C., at the age of seventy-three, the sage died and was buried.

His grandson had become one of his disciples and was second to Confucius alone in wisdom. He was the teacher of the illustrious Mencius who did more to spread the teachings of Confucius than any other one man. Through this grandson the family of Confucius has been continued until to-day, after about seventy generations, the descendants number about forty thousand. The Four Books which contain the doctrines of Confucius are not written by himself but by disciples of his. The Sacred Books of China are arranged as follows:

*A. The Five Kings.*

King means a web of cloth or the warp which holds the threads in place.

| | |
|---|---|
| 1. Yih-King. | Changes. |
| 2. Shoo-King. | History. |
| 3. She-King. | Odes. |
| 4. Le-Ke-King. | Rites. |
| 5. Ch'un-Ts'eu. | Spring and Autumn. Annals from B.C. 721-480. |

*B. The Four Books.*

| | |
|---|---|
| 1. Lun-Yu | Analects or table-talk of Confucius. |
| 2. Ta-Hig. | Great learning by Tsang-Sing. |
| 3. Chung-Yung | Doctrine of the mean by Kung-Keih, grandson of Confucius. |
| 4. Work of Mencius. | |

Confucius contributed very little to the religious wealth of his country. All that has been described as the early religion was in effect in his day as it is to-day. His mind was very practical and he seemed to be averse to any discussion of spiritual or purely philosophical questions. He claimed to be agnostic concerning the next life and the world of the gods. His mind was filled with affairs of this life, with conduct, the development of character, the relations of man with man, with the state and all the complicated affairs of government. In addition to his political work, Confucius paid the most careful attention to the culture of the individual self. The Confucian ideal of the superior man finds its best exemplification in Confucius himself, though he modestly makes no claim to personal attainments. He presents the picture of a grave and dignified gentleman, somewhat stooped by study and earnest thought, holding himself in perfect and dignified control, ready to offer advice to all and seeking by the power of example and admonition to lead others in the straight and narrow way. He says of himself: "He is a man who through his earnestness in seeking knowledge forgets his food, and in his joy in having found it loses all sense of his toil, and thus occupied is almost unconscious that he has reached old age."

Also: "Grieve not that men know not you; grieve that you know not men."

"The essence of knowledge is, having it, to apply it; not having it, to confess your ignorance."

"Worship as though the Diety were present."

"If my mind is not engaged in my worship, it is as though I worshipped not."

Confucius believed in reciprocity. He would have men take care not to do to others what they would not want done to themselves. This idea is typical of Confucius and the Chinese in that it is negative and without any challenge.

Although Confucius was essentially a moral teacher, Confucianism has developed as a religion. Temples in which tablets of the sage and his disciples are displayed are to be found in all centers of worship.

Whatever may be our opinion of Confucius' teachings, we must recognize his ability and it certainly increases our hope for mankind when we see how these qualities of perfect honesty, good sense, generous devotion to the public good, and fidelity to the last in his adherence to his work have made Confucius during twenty-three centuries, the daily teacher and guide of a third of the human race.

The second great religion of China is Taoism. The founder, Loa-tse or Laotius, was, like Confucius, a philosopher laying no claim to supernatural powers. He was born in 604 B.C., about fifty years before Confucius. Laotius is said to have been the keeper of the archives of the imperial court of the Chao dynasty. Seeing the country and government falling to decay, he became more and more discouraged till finally he resigned and retired. He still was in the midst of chaotic conditions caused by the never-ending wars of the small feudal states and decided on a still more drastic step. He started off into exile and reached a noted mountain pass where the keeper induced him to put down in writing the philosophy he had worked out and which otherwise would have been lost. Laotius stayed and wrote the Toa-teh-king, a writing of about five thousand Chinese characters. Leaving this in the care of the keeper, he passed on and disappeared. We may question this picturesque account but it is all we know of the life of Laotius.

Laotius was a lover of nature. In nature he saw quiet, humility, and self-effacement—placidity, emptiness, and freedom from effort. The passive processes of nature impressed him and from them he developed his philosophy. Laotius, as a result, developed into one of the quietest of thinkers. He did not even teach his doctrines.

The teachings of Confucius, negative as they are, carry far more life than the thoughts of Laotius and, as a result, China has gone with the teacher.

A study of China leads to a better understanding and a deeper respect, for a country with such institutions and such a social life cannot be despised.

CHARLES W. HILLS CHARLES W. HILLS, Jr.

CHARLES W. HILLS

PATENT, TRADE MARK, COPYRIGHT AND UNFAIR COMPETITION LAW

1523-38 MONADNOCK BUILDING

CHICAGO

*Telephone, Harrison 6150*

*Cable Address Hillsford, Chicago*

MISSISSIPPI - WIRE - GLASS - CO.
WG
FIRE RETARDANT No. 32

STRAUS BUILDING · *Chicago*
Graham, Anderson, Probst & White
*Architects*

MISSISSIPPI WIRE GLASS CO.
220 Fifth Avenue
*Chicago* New York *St. Louis*

## ENGINEERING NEWS

(Continued from page 68)

we could have used more had the power been obtainable. The next step will be to make the simple device commercially practicable."

## THE COOLIDGE DAM

The Coolidge dam, to be constructed on the Gila River, near San Carlos, Arizona, will impound a reservoir for the irrigation of about 100,000 acres of land in Pinal County, and will benefit both the Pima Indians of the Gila River reservation and the white landowners in the vicinity. The project seems a certain success. The whole character of the land is very similar to that of the Salt River project, which is nearby and is considered one of the most important irrigation areas ever opened with the assistance of the government. The only cause for doubt is the Gila River itself, which is rather irregular, sometimes flooding the valley without warning, and sometimes running dry.

The section to be benefited by the dam is one of the oldest irrigated regions in the United States. Traces of irrigation canals built by pre-historic indians are still visible, and the Pimas and Apaches today carry off water for their fields near the river by means of acequias.

Although the project was approved by Congress and appropriations were made previous to our entrance into the World War, construction was deferred until after the hostilities had ceased, on account of the scarcity of both labor and material. Work was started in 1921, and at present the finished parts of the plan are a diversion dam across the Gila River above Florence, a diversion dam and bridge near Sacaton, and the main trunk canals heading at the dam.

During the construction of these, the river was particularly low, and the Pima Indians suffered considerably from the lack of water, although the smaller dams, when finished, were of some benefit. In June, 1924, Congress, through the efforts of friends of the Indians and of white ranchers in the vicinity, passed an act authorizing the Indian Bureau to construct a dam to cost not more than $5,500,000. This act also changed the name from the San Carlos dam to the Coolidge dam, in honor of the president.

The Southern Pacific Railroad, which has a line running through the canyon in which the dam is to be built, has, seeing the benefit to be gained by the improvement of territory which it serves, agreed to pay half cost of rebuilding the line. Estimates indicate that this work will cost about $2,000,000.

Meanwhile, a small group of expert engineers had been engaged on the design of the dam. Six different types were considered, and the cost of each estimated. These included two types of gravity dam, a rock fill dam, a variable radius dam, a multiple arch dam, and the final decision, the multiple dome dam, a development of the multiple arch and variable radius designs.

The discharge of the Gila river at the dam site varies from a few second-feet during the dry season to about 92,000 second-feet during maximum flood, the mean annual run-off being about 400,000 acre-feet. The dam will rise 220 feet above the river bed. The resulting reservoir, having an approximate capacity of about 1,200,000 acre-feet, will form a lake extending up the valleys of the Gila and San Carlos rivers a distance of about twenty-five miles, with a maximum width of about two miles. The length of the dam at the bottom will be about three hundred feet, while the distance along the crest is 580 feet, exclusive of the two 150 foot spillways. The distance from the rear of the dome along the base of the dam to the toe of the buttress is 286 feet. The buttresses are spaced 180 feet on centers and on the downstream side vary from 60 feet in thickness at the base to 24 feet at the narrowest section which occurs immediately below the spring of the arches forming the bridge.

The sliding factor of the dam when the reservoir is full is 0.73 without uplift with 50 per cent uplift at the heel diminishing to zero at the toe of the buttresses it is 0.70. The overturning factor with the reservoir full without uplift is 2.83; with uplift, 2.00. In the design, as precaution against uplift, the foundation will be grouted; the dam will be anchored to its base and provided with inspection and drainage galleries.

A 1:2:4:2 concrete will be used in the arches, 1:2½:5:2½ in the buttresses which before the dam receives its full load should develop strengths of at least 3000 and 2500 lbs. per sq. inch respectively, corresponding roughly to a factor of safety of five against crushing.

The adoption of the multiple dome type of dam over the gravity type, the relocation of the railroad and the willingness of the Southern Pacific company to pay half the cost of reconstruction have saved to the project a sum approaching $5,000,000 over previous estimates.

## THE ARMOUR ALUMNUS
### Maintenance Fund Drive

(Continued from page 80)

fostered such a spirit of co-operation and enthusiasm among the different class and district chairmen that the success of the drive was never seriously questioned. Their untiring and zealous efforts resulted in a participation of 63 per cent of all the graduates in this fund. The number interested in the destiny of the Institute and who expressed their concern was far greater, but there are always those who cannot financially support movements that they heartily believe in. Subscriptions came from all over the United States, countries in Europe, insular possessions of the United States, and the Orient. So well was the campaign planned that it would not be altogether wrong to report a 100 per cent success for the efforts of the workers, in that 63 per cent subscribed to the Fund and of the remaining 37 per cent, everyone was interested and anxious for the success of the drive and, although their circumstances would not permit them to aid financially, they were glad to talk up the cause with every alumnus and former student whom they encountered, with the result that there exists today among the alumni body, and former students as well, a great common interest, a closer relationship, a wonderful spirit of enthusiasm—precious legacies that the Board of Trustees hope to enkindle for greater things.

With the future of Armour Institute of Technology now just about assured, the different departments and authorities are undertaking their life's work with a new zeal. They can go on planning for the future work, climbing to a greater goal—a new Armour, adequately equipped and financed, an educational giant in its service to the engineering profession of the future.

## F. E. MOSKOVICS

(Continued from page 59)

men, and advocates that branch managers hold at least three sales meetings a week."

Mr. Moskovics was born in Budapest, Hungary, came to America with his family when he was quite young, and received his early education in Kansas City. He holds the distinction of being the first registrant to pay his fees as a student when Armour opened its doors for the first time back in 1893.

To quote the *Kansas City Star*, "Mr. Moskovics, in 1896, went to Europe, where he took post-graduate technical courses in various schools and got his first real experience in the automotive industry.

"He came back to America with his parents in 1898.

"In 1900, Mr. Moskovics did what he called 'a little racing around on motor cycles' and became the first sales manager of the Continental Tire Company. He left that business in 1905 to become a partner in Brandenburg Brothers, designing, manufacturing, and selling motor parts. In 1907 he

(Continued on page 78)

ALUMNI
OF THE
ARMOUR INSTITUTE of TECHNOLOGY
ARE INVITED TO JOIN THE
COLLEGIATE CLUB of CHICAGO
Over a half hundred Armour Men have already joined the Club
(ASK THEM OR ANY ONE OF THE 1700 OTHER MEMBERS ABOUT IT)
COLLEGIATE CLUB of CHICAGO
Executive Offices
510 Portland Block 35 North Dearborn Street State 5836

KEYSTONE COPPER STEEL

## Steel Sheets that Resist Rust!

The destructive enemy of sheet metal is *rust*. It is successfully combated by the use of protective coatings, or by scientific alloying to resist corrosion. Well made steel alloyed with Copper gives maximum endurance. Insist upon

# KEYSTONE
## Rust-Resisting Copper Steel
# Sheets

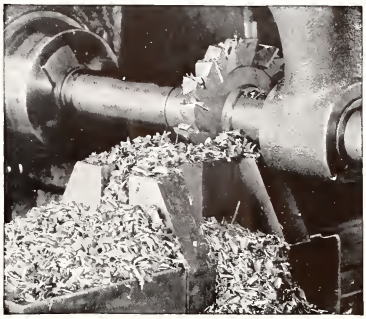
*Black and Galvanized*

Keystone Copper Steel gives superior service for roofing, siding, gutters, spouting, culverts, flumes, tanks, and all uses to which sheet metal is adapted—above or below the ground. Our booklet *Facts* tells you why. We manufacture American Bessemer, American Open Hearth, and Keystone Copper Steel Sheets and Tin Plates.

**Black Sheets for all purposes**
**Keystone Copper Steel Sheets**
**Apollo Best Bloom Galvanized Sheets**
**Apollo-Keystone Galvanized Sheets**
**Culvert, Flume, and Tank Stock**
**Corrugated Sheets**
**Formed Roofing and Siding Products**
**Automobile Sheets—all grades**
**Electrical Sheets, Special Sheets**
**Deep Drawing and Stamping Stock**
**Tin and Terne Plates, Black Plate, Etc.**

Our Sheet and Tin Mill Products represent the highest standards of quality, and are particularly suited to the requirements of the mining, engineering, and general construction fields. Sold by leading metal merchants. Write nearest District Office.

American Sheet and Tin Plate Company
General Offices: Frick Building, Pittsburgh, Pa.
DISTRICT SALES OFFICES
Chicago Cincinnati Denver Detroit New Orleans New York
Philadelphia Pittsburgh St. Louis
Pacific Coast Representatives: UNITED STATES STEEL PRODUCTS CO., San Francisco
Los Angeles Portland Seattle
Export Representatives: UNITED STATES STEEL PRODUCTS CO., New York City



## *Judge a Cutter by its Chips*

THE worth of a cutter is measured by its chips, and the costs in the milling department of any plant are measured by the "cut ability" of the cutters.

Here is a Brown & Sharpe Staggered Tooth Side Milling Cutter taking a cut 1⅛" wide and 2" deep in steel, and the chips tell a story of clean-cutting performance. But the picture cannot show you the long record of steady service Brown & Sharpe Cutters make on such production work, when every moment gained or lost shows up on the cost sheet.

In the constantly increasing number of plants where "rock bottom milling costs" is the watchword, you'll find much of the cutter equipment stamped Brown & Sharpe.

There is considerable information about cutters in the No. 30 Small Tool Catalog. We will gladly send a copy at your request.

BROWN & SHARPE MFG. CO.
PROVIDENCE, R. I., U. S. A.

# Armour Institute of Technology
## Chicago

### The College of Engineering Offers Courses in

ELECTRICAL ENGINEERING
MECHANICAL ENGINEERING
CIVIL ENGINEERING
FIRE PROTECTION ENGINEERING
CHEMICAL ENGINEERING
ARCHITECTURE

*These courses are each four years in length and lead to the degree of Bachelor of Science*

COMPLETELY EQUIPPED SHOPS AND LABORATORIES

### *The* Institute Bulletins
Will be Sent on Application


### F. E. MOSKOVICS

(*Continued from page 76*)

designed his first motor car, the Allen-Kingston, which many critics said was the first American car ht to compete with foreign machines in racing. The comoany died in the panic of that year. Mr. Moskovics went to the Remy Electric Company of Anderson, Indiana, as sales manager for two years, and in 1913 joined the Nordyke-Marmon organization, where he worked up to the post of vice-president."

Later, he became vice-president of the Franklin Automobile Company, a position which he held until his association with the Stutz Company.

### THE UNOFFICIAL OBSERVER

(*Continued from page 60*)

silence for a while, and the Freshman thought he had finished. But when the pipe was drawing well again he resumed. "Many estimable pedagogues will tell you that the test of the engineer is his ability to mingle on terms of equality with people of culture and refinement. 'Therefore,' they say, 'we must give the engineer all the cultural training possible, in order that he may not fail in this great test.' The firm by which I am employed and which depends upon me to pass on all the materials which it buys cares less about the cultural tests of the engineer than it does about the ability of the Engineer of Tests. Now, do not misunderstand me; get all the cultural training that you can but remember that your professional training comes first. In selecting a college I think you have chosen wisely, for they will see that the transition from student to worker shall be no high dive for you. Your college course will be no primrose path, but by the same token your first year in practice will be no Gethsemane."

The speaker stopped; his pipe had gone out and he knocked the dead ashes into the grate and prepared to go to bed. Greatly relieved and with a new vision of his chosen profession before him, the Freshman went to his room and to bed, while on his face there lingered the expression of one who has been on the mountain top.

LUFKIN

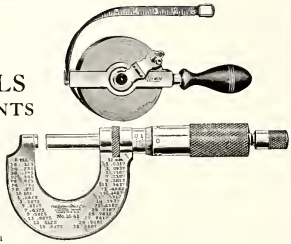
TAPES, RULES, TOOLS
INSURE YOUR MEASUREMENTS

On Sale Everywhere
Send for Catalog

THE LUFKIN RULE CO.

Saginaw, Michigan

New York Windsor, Canada



# LALLY COLUMNS

*are*

Steel-Shell,
Concrete-Filled
Building Columns
*with*
Steel Caps and Bases

*Dependable*
*—Economical*

Have Given Satisfaction
for 29 Years

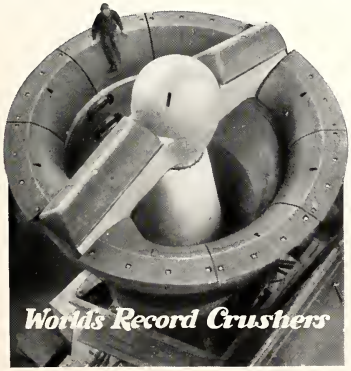
*Prompt Shipment*

LALLY COLUMN CO.,
OF CHICAGO
4001 Wentworth Ave.,
CHICAGO, ILL.

Boulevard 5871-72

LALLY COLUMN
"Stack Construction"





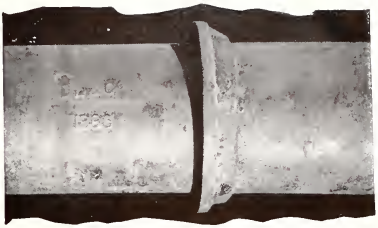

These two crushers, which weigh a million pounds each, establish another World's Record for the lines of heavy machinery built by Allis-Chalmers Manufacturing Company.

A carload of ore weighing 70 tons each can be dumped into the crusher at one time. Each crusher handles from 2,000 to 2,500 tons of ore per hour.

Send for "The Story of the World's Record Crushers."

ALLIS-CHALMERS MANUFACTURING CO.
MILWAUKEE, WIS. U.S.A.





# Bell and Spigot Joint

THE Bell and Spigot Joint for Cast Iron Pipe, adopted over one hundred years ago, is the preferred joint today.

It is tight, flexible, easily made and non-corrodible. There are no bolts to rust out. It makes changes of alignment or insertion of special fittings a simple matter. It can be taken apart and the pipe used over again, without any injury. It is not subject to damage in transit. In fact, it embodies practically all of the desirable qualities in an underground joint.

The use of this type of joint, together with the long life of Cast Iron Pipe, makes for extremely low maintenance costs.

THE CAST IRON PIPE PUBLICITY BUREAU
Peoples Gas Bldg., Chicago

# CAST IRON PIPE

*Our new booklet, "Planning a Waterworks System," which covers the problem of water for the small town, will be sent on request*

THE BELL & SPIGOT JOINT
THE ACCEPTED STANDARD FOR UNDERGROUND CONSTRUCTION

*Send for booklet, "Cast Iron Pipe for Industrial Service," showing interesting installations to meet special problems*

# *To the* RAILROAD MEN *of* AMERICA

An opportunity is ripe for saving about seven-eighths of the power now needed to start trains.

Hence heavier freights and smoothest passenger service are practical with present motive power.

A major economy can also be effected in car lubrication. Most of this cost is avoidable, with every requirement of maintenance and safety being met by journal inspection months apart! *Yet hot boxes will become unknown.*

Indeed, all the chief causes of wear and tear disappear from trucks and draft gear, as the old sliding friction in journals is supplanted by perfectly lubricated rolling motion, confined entirely to hardened, ground, special alloy steel, of utmost durability.

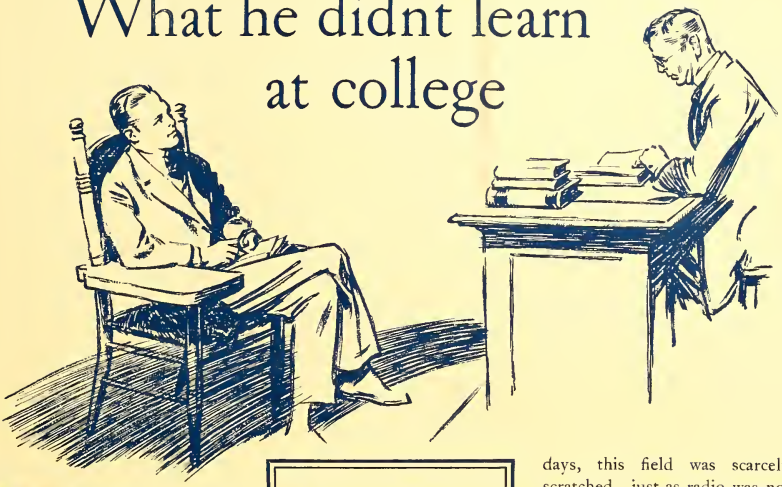
An established, conservative, highly successful, world-respected engineering institution sponsors all this. It is being accomplished today by means of Timken Tapered Roller Bearings. They have become universal throughout transportation and other industries.

Data on Timken Bearings in car journals, and any desired engineering counsel, are at the disposal of every railroad. THE TIMKEN ROLLER BEARING CO., CANTON, OHIO

H. H. Timken

*Please mention The Armour Engineer*

# What he didn't learn at college



LAWRENCE DAY HOWELL

In his class work, Lawrence Day Howell, Princeton, Litt. B. '13, E. E. '19, never heard of marine applications for electrical equipment. In fact, they were practically unknown. Yet he now is in charge of the Marine Section, Transportation Division, of the Westinghouse Sales Department, located at New York.

When Howell came from college to the Westinghouse Graduate Students' Course, he had twelve months of thorough-going work in the shops at East Pittsburgh. Then he decided he wanted to enter the field which seemed most undeveloped and perhaps most promising of broad expansion. This was marine engineering.

*"What's the future with a large organization?" That is what college men want to know, first of all. The question is best answered by the accomplishments of others with similar training and like opportunities. This is one of a series of advertisements portraying the progress at Westinghouse of college graduates, off the campus some five—eight—ten years.*

Not five per cent of the present opportunities on the water have been opened for electrification Yet there is more horsepower, in prime movers, on the ocean than there is on the land.

In Howell's undergraduate days, this field was scarcely scratched—just as radio was not known to many young engineers when they were in college. A college man's opportunities are not limited to the electrical developments now in existence.

In marine applications an order may assume large proportions. A single installation, negotiated by Howell recently, of the newly-developed Diesel-electric drive for a yacht, totaled $175,000. Such sales are not made overnight. They result from understanding fully a customer's needs.

To men with the knack of taking the other fellow's point of view, a career as Sales Engineer at Westinghouse brings returns in personal satisfaction as well as in worldly reward.

**Westinghouse**

WESTINGHOUSE ELECTRIC

# 832 miles for $11.90

On its initial trip from Schenectady to **Chicago** this Oil-Electric Locomotive, running **light,** traveled at a cost for fuel of less than **1½ cents** a mile—832 miles for $11.90.

Five big railroads are already using this new type of **locomotive.** Developed jointly by the American Locomotive Company, the Ingersoll-Rand Company, and the General Electric Company, it is a significant example of what co-ordinated effort can produce.

A series of G-E advertisements showing what electricity is doing in many fields will be sent on request. Ask for booklet GEK-18.

One operating official estimates that this locomotive will save the Chicago & Northwestern Railway more than $10,000 a year. Every year electricity finds new ways to help the industries and homes of the nation.

The college graduate is the leader in these discoveries, whether it be in science or in applying known equipment to new uses. Think of electricity as a tool to help you along the paths of progress, no matter what your life's work may be.

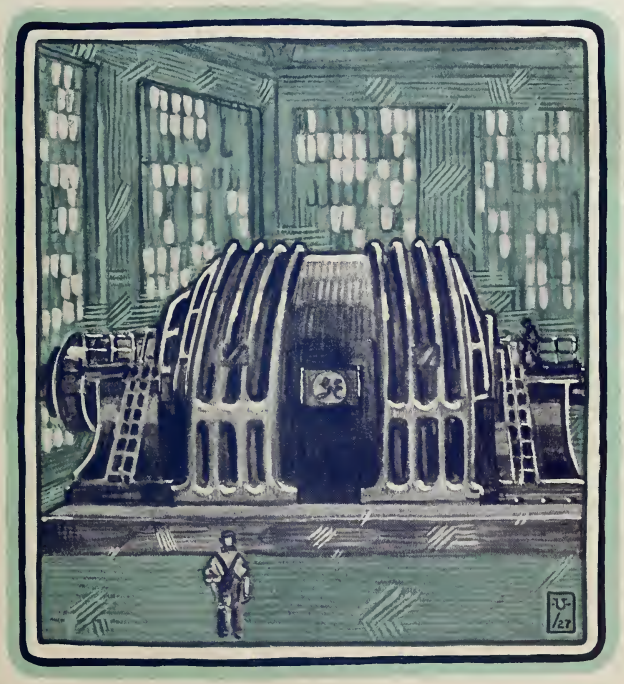
391-10DH

# GENERAL ELECTRIC

GENERAL ELECTRIC COMPANY, SCHENECTADY, NEW YORK

# The ARMOUR ENGINEER

VOL. XVIII MARCH, 1927 NO. 3



*Published Quarterly by the College of Engineering*
*Armour Institute of Technology*
*Chicago, Ill.*

*Member of Engineering College Magazines Associated*

# *On* Timken Bearings

In the epic history of the railroads a new chapter opens. Cars regularly equipped with anti-friction bearings are here. Timken Bearings make it possible. The first standard Timken-equipped cars go into operation on the Chicago, Milwaukee and St. Paul.

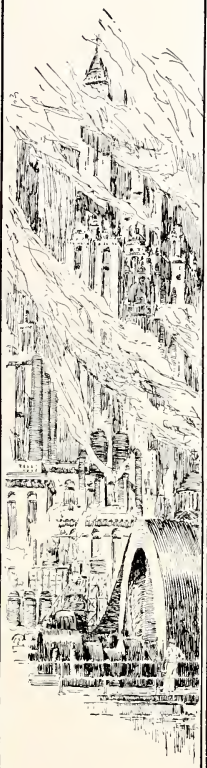
Timken Tapered Roller Bearings for this progressive railroad's crack flyers, THE OLYMPIAN and THE PIONEER LIMITED, mark the day of new ease, quiet and surety in long distance travel.

On guard against the wear and waste of friction, Timken Tapered Roller Bearings not only conserve power, but put an end to hot boxes and the whole lubrication difficulty.

Steel wheels speeding steel grades and curves cause stresses which have been thought beyond anti-friction bearings. Here again, as in every other type of mechanism, throughout Industry, the "impossible" has yielded to Timken design, construction, and resources.

THE TIMKEN ROLLER BEARING CO., CANTON, OHIO

**TIMKEN *Tapered Roller* BEARINGS**



# Men Wanted

OVER the door of America's largest commercial and industrial organizations is a permanent legend—Men Wanted.

The modern business organization, realizing its surest and sanest method of progress rests in excellence of man power, places much emphasis on the selection of its personnel.

Thousands of men are drawn each year from the senior classes; in fact, the University is the American Man Market.

Ingersoll-Rand Company offers splendid opportunities to those interested in the research, manufacture, or sale of pneumatic machinery, internal combustion engines, pumps, and steam condensing plants.

**Ingersoll-Rand**
11 Broadway, New York City

1902 1927

# Owners Repeat and Diversify

JUST a quarter of a century ago four young men, with a broad background of training and experience in the engineering construction field, formed The Foundation Company. Today the company is at work in every continent, in both hemispheres, and on both sides of the Equator, on engineering construction of almost every known type.

Woolworth Building, New York
*Foundations Only Until 1915*

First National Bank, Detroit
*Complete Construction Since 1915*

DURING the first decade of this quarter century the skyline of New York began to take new form resting on the secure foundations constructed by this organization; then many owners, in other localities, noting the manner of its building, awarded to The Foundation Company contracts for complete construction, so that now the building of superstructures forms a great part of its work.

AS indicative of the service rendered by The Foundation Company over this period of years, these partial lists of repeat contracts have special significance. In one case no less than thirty contracts have been awarded by one owner.

| New York Telephone Co. | | Union Gas and Electric Co. | | Canadian Pacific Railway | |
|---|---|---|---|---|---|
| Foundations | 1916 | Foundations | 1916 | Station Foundations | 1909 |
| Foundations | 1919 | Power House | 1918 | Righting Elevator | 1916 |
| Foundations | 1923 | Office Building | 1923 | Locomotive Shops | 1920 |

## THE FOUNDATION COMPANY

### CITY OF NEW YORK

*Office Buildings*
*Industrial Plants*
*Warehouses*
*Railroads and Terminals*
*Foundations and Underpinning*
*Filtration and Sewage Plants*

ATLANTA
PITTSBURGH
CHICAGO
SAN FRANCISCO

LOS ANGELES
MEXICO CITY
CARTAGENA, COLOMBIA
LIMA, PERU

MONTREAL
LONDON, ENGLAND
BRUSSELS, BELGIUM
TOKYO, JAPAN

*Hydro-Electric Developments*
*Power Houses*
*Highways*
*River and Harbor Developments*
*Bridges and Bridge Piers*
*Mine Shafts and Tunnels*

BUILDERS OF SUPERSTRUCTURES AS WELL AS SUBSTRUCTURES

# THE ARMOUR ENGINEER

*Published Quarterly by the College of Engineering*

ARMOUR INSTITUTE OF TECHNOLOGY

Volume XVIII March, 1927 No. 3


## Table of Contents


Cover Design, a Drawing of One of the World's Largest Turbo-Generators, by John William Urban, '27. (A discussion of recent high capacity turbo-generator installations appears in the Engineering News Section.)

Electrical Engineering ..... 85
E. H. Freeman, '02.

The Chicago Lake Front Development ..... 86
Linn White.

Centrifugal Pump Efficiency ..... 88
L. G. L. Thomas.

Radioactivity and Atomic Structure ..... 91
J. S. Thompson.

A Research Unit in the Book Paper Industry ..... 94
D. E. Cable, '18.

The Unofficial Observer ..... 98
J. C. Peebles, '04.

The Armour Alumnus ..... 99
J. Warren McCaffrey, '22.



Published in November, January, March, and May by the College of Engineering, Armour Institute of Technology. Publication office: 3300 Federal Street, Chicago, Illinois. Subscription price, $1.50 per year, postage prepaid. Single copies, fifty cents.



ENGINEERING COLLEGE MAGAZINES ASSOCIATED

*Chairman:* Professor Leslie F. Van Hagan, Madison, Wisconsin.

Armour Engineer
Colorado Engineer
Cornell Civil Engineer
Illinois Technograph
Iowa Engineer
Iowa Transit
Kansas Engineer
Kansas State Engineer
Michigan Technic
Minnesota Techno-Log
Nebraska Blue Print
Ohio State Engineer
Penn State Engineer
Pennsylvania Triangle
Princeton News-Letter
Purdue Engineering Review
Rose Technic
Sibley Journal of Engineering
Tech Engineering News
University of Virginia Journal of Engineering
Wisconsin Engineer

**We urge our readers to take advantage of the technical information that our advertisers will gladly furnish upon request**


COPYRIGHT, 1927, BY THE ARMOUR ENGINEER

# *Uplift Applied To Monuments By Otis Elevators*

THE Englishman confessed to his American friend whom he was conducting through the London Tower that never before had he visited that most historic building of his native city. It was always there; he could go any time. So he never did, until the insistent American prodded him into action.

Is it for a similar reason that so few college students in and around Boston visit the Bunker Hill Monument? Hardly: because they come from all parts of the country. Is it then another instance of indifference of college men? Not that either. College men in Washington generally ascend the Washington Monument.

No expert is needed to solve this puzzle. The ascent of the Bunker Hill Monument must be made on foot. It's a long, hard climb. But visitors to the Washington Monument are speedily and comfortably borne to the top in an Otis elevator.

© Harris & Ewing

AMERICAN HISTORY

1799—December—Congress passed Resolution for erection of marble monument in memory of George Washington.

1833—Corner Stone laid—

1839—Work stopped—

1880—Work resumed—

1884—100 oz, pure aluminum cap stone set.

1884-1926 Over 5,000,000 people ascended to top of Monument.

ELEVATOR CHRONOLOGY

1879—Otis Steam Elevator, installed for use in construction work.

1884—This elevator converted to passenger use. Round trip 17 minutes. Passengers carried to the top of the monument during the life of the elevator, 1,279,719.

1901—Electric Elevator installed, having a round trip time of 10 minutes. Passengers carried up during its lifetime, 3,750,000.

1926—Otis Micro-Drive Gearless Traction Elevator installed, with a round trip time of 2 minutes. Will carry to the top of the monument an estimated number of 12,000,000 passengers in the same time as the life of its predecessor.

OTIS ELEVATOR COMPANY

Offices in All Principal Cities of the World

*The*
# ARMOUR ENGINEER

VOLUME XVIII | MARCH, 1927 | NUMBER 3

## ELECTRICAL ENGINEERING

**By E. H. FREEMAN, '02**

***Professor of Electrical Engineering***

WHAT is electrical engineering, what does an electrical engineer do, and what does he need to know are questions that are being asked repeatedly and for which no short answers, definite and adequate, can be given; for the field of electrical engineering is broad with continually increasing boundaries which penetrate and merge more or less indefinitely into other fields of engineering; and the work of the electrical engineer and the knowledge he uses are so varied that only rather general ideas concerning them can be given in a brief discussion of the subject.

In very general terms, it may be said that electrical engineering is the application of electric and magnetic principles to useful purposes; the electrical engineer busies himself in finding ways of applying new principles, of improving and extending old applications; and, as has been said in many other places, all he needs to know is how.

A better conception of the field may be obtained by noting that electrical engineering is one of the youngest of the major divisions of engineering, and by very briefly tracing its growth. Although the telegraph has been used for almost a hundred years, things electrical got their start in a commercial way about fifty years ago with the invention of the telephone, the practical development of the electrical lamp, and the production of generators and motors in useful sizes. Since then, these means of communication, of lighting, and of power applications have increased enormously so that now there is one telephone for about every seven inhabitants of the United States, five hundred sixty million electric lamps are produced yearly and every factory worker has, on the average, over

E. H. Freeman

five horse power in electric motors to assist him in his work. Electric transportation both horizontal and vertical has made tremendous growth in about forty years of existence. The number of passengers carried per annum by the street railway systems of the country is almost beyond belief.

Due to the ease and economy with which energy can be transmitted electrically, transmission systems hundreds of miles in extent have been developed, connecting large generating stations with cities great and small, and promoting the use of electric power for a wide variety of purposes. This has been made possible by the making of large electric generators and high voltage transformers. It is interesting to remember that in the year Armour Institute of Technology was opened, there was exhibited at the World's Fair in Chicago, an electric generator of 1500 kilowatts capacity—a marvel of its day. Within a short time from now and not far from the site of this World's Fair, there will be installed an electric generating unit of 200,000 kilowatts capacity—more than one hundred times greater than the largest in existence thirty-four years ago.

The economical transmission and utilization of electric energy has quite naturally stimulated very greatly many kinds of manufacturing including, of course, the manufacture of all sorts of electrical equipment and devices which now exceed a value of $1,000,000,000 annually. It is thus apparent that while the electrical industries are comparatively young, they have grown rapidly and are now of such magnitude as to have an important bearing upon social and economic organization.

The work of the electrical engineer may generally be classified in three major divisions. He may concern himself with the manufacture, the operation, or the sale of electrical equipment.

In manufacturing, he may conduct research to discover new applications of electrical principles, design and develop improvements in old devices, or engage in production where electrical knowledge is essential. Manufacturers in general are finding it profitable to engage in research and development work in connection with the devices they manufacture and electrical manufacturers have been especially prominent in this line. As a result of this kind of work, electrical engineers are continually bringing

*(Continued on page 97)*

# THE CHICAGO LAKE FRONT DEVELOPMENT

*From a Paper by* LINN WHITE

*Chief Engineer, South Park Commission*

CHICAGO was located at the mouth of the Chicago river because the portage over the divide between the Desplaines and Chicago rivers was short. When the railroads were built into the city on the lake, which was developing rapidly but much at random, they followed the valleys between the hills and the ridges through the low, swampy lands. It was thus the Illinois Central Railroad's route was located in 1852, when the population of Chicago was about twenty-five thousand, the last six miles before reaching the mouth of the Chicago river passing over the sand dunes built up by the waves and winds along the lake shore. Doubtless it was considered by the city fathers of that day quite an excellent thing to have the rather uncertain shifting lake shore stabilized by railroad tracks. But as time went on and the great South Side grew populous, new communities such as Hyde Park, Woodlawn, Englewood, South Chicago, etc., grew up and were annexed to the city and the fact was forced upon the consciousness of the people that between the Illinois Central Railroad on the lake front and the growing network of railroads to the west, there were only three through streets leading southward from the loop district where business was centered. Two of these, Wabash and State, were preempted by street car tracks and heavy traffic. Only one, Michigan Avenue, was left for light, fast-moving traffic. The growth of business southward was throttled and, on the other hand, much of Michigan Avenue was rapidly abandoned as a residential street due to crowded traffic and was only saved from that nondescript condition of one halfway between business and residential by the rapid development of the automobile business. It developed into one of the greatest "automobile rows" in existence.

However, there soon came a time when even the retail automobile business suffered by the continual flow of automobile traffic past its doors. Necessary traffic regulations restricted parking and left turns and it was difficult to find a stopping place. The automobile owner who wanted accessories sought some less crowded street. Thus the very interests that built up Michigan Avenue as a business street welcomed the opening of other routes for through north and south bound traffic and the south side lake front extension became more and more of a necessity.

The idea of pushing the shore line outward into the shallow waters of Lake Michigan from Grant Park south to Jackson Park, originated about 1893, during the World's Fair. There were many obstacles to overcome.

The railroad occupied most of the water front throughout this distance and of course was possessed of riparian rights. State legislative action was necessary and, above all, the consent of the Congress of the United States had to be obtained as the proposition involved encroachment on navigable waters. The idea was kept alive through the passing years by the devotion of a few patriotic citizens, chief among whom may be mentioned the late D. H. Burnham. He drew maps and plans, exhibited them and never missed an opportunity to talk of the project publicly and privately. Before the time came for him to drop the reins, the Chicago Plan Commission, an important branch of the city government acting in an advisory capacity only, had made the south shore extension one of the major items in its plan of a Greater Chicago and thus the people of Chicago became pretty well sold on the idea. However, there were some stormy times ahead on the sea of local politics and conflicting interests before the dream could become a reality.

First the question had to be settled as to what corporate body should do the work. There were reasons why it was inadvisable for the city government at large to undertake the project. The city's bonding power was limited by law and it would have been difficult to get legislative extension of this power for the purpose and perhaps more difficult to secure a vote of the city at large in favor of such a bond issue as it would inevitably have been considered peculiarly for the benefit of the south side.

The South Park Commissioners is a body created by legislative charter, and while the South Park district lay within the corporate limits of the city, it included just those portions of the city that would be especially benefited—the south side and the central business district. The Commissioners had bonding powers and were practically independent of the other branches of the city government. It became evident that the South Park Commissioners was the logical organization to undertake the work.

In 1912 an agreement was entered into between the South Park Commissioners and the Illinois Central Railroad whereby the railroad company agreed to relinquish all riparian rights in return

Preliminary plan of the Chicago Lake Front Development, showing the extensive filling operations.

for certain concessions as to width of right of way. The plans of the railroad were, however, complicated by its desire to build a new terminal on its property and the insistence of the city on electrification of its service within the terminal zone. Finally, in July, 1919, all these plans were correlated and set forth in the form of a city ordinance which when accepted by the railroad company and ratified by the South Park Commissioners became a contract.

The South Park Commissioners obtained by vote of the Park District a preliminary bond issue of $8,000,000 which was in 1925 increased by $15,000,000 making $23,000,000 available for the first sections of the project. In October, 1920, the first contract on the new project was let for 7490 feet of bulkhead to retain the fill, amounting to $1,182,698. Up to July 1, 1926, the actual expenditures were approximately $14,500,000 with several million dollars of unfinished contracts under way. It is worthy of note that in acquiring six miles of riparian rights along the shore of Lake Michigan, 80% of which belonged to the Illinois Central Railroad and 20% to private owners, the South Park Commissioners did not pay out one dollar in the purchase of such rights. All has been accomplished by making comparatively small adjustments in lines here and there and holding strongly to the idea that a development of the kind proposed would inevitably increase the value of adjacent properties.

© Chicago Aerial Survey Co.

Bird's-eye view of Lake Front project, illustrating the work in progress.

The whole area included in the south shore extension project is 1700 acres, of which there will be 1200 acres of made land and 500 acres of water in the form of an enclosed waterway or lagoon for the whole six mile length, a veritable "river in the lake." The total length of the filled area will be six miles and the total width varying from 1200 to 3000 feet. The width of the enclosed lagoon will be from 300 to 600 feet. The depth of water varies from six to eight feet at the old shore line to sixteen to twenty feet at the outer edge of the new made land, or the new shore line. It is estimated there will be required 65,000,000 cubic yards of filling to complete the whole project. Of this amount from 750,000 to 1,000,000 cubic yards per year is obtained from city wastes, miscellaneous excavations, etc., which will be obtained at no cost to the Commissioners except for maintaining a free dump and dressing the material to grade. The bulk of the filling, however, will be obtained from the Lake bed by dredging operations and the top soil, needed to maintain plantation and lawns, by rail from farm lands. Most of the lake bed adjacent to the areas to be filled is clay or silt of mixed character. This material, which will constitute the larger part of the dredged filling, is handled principally by the standard type of hydraulic dredge discharging through pipe lines directly into the fill. Up to date it has not been found necessary to discharge through very long pipe lines, not over 3000 feet in any case. In some cases, however, where the water is deep enough the filling is more economically handled by the use of dipper dredges and scows.

In some parts of the fill it is found more desirable and economical to have sand, especially for beaches and where the material has to rehandled. Most of the sand used for these purposes has to be obtained from points several miles distant where heavy bars are formed. It is transported in sea-going dredges locally known as sand boats. Loading is accomplished by dropping a suction pipe down on either or both sides of the vessel, the sand as drawn in with the water settling in the bins and the water overflowing through suitable outlets. If the bins are filled above the water line no water remains but if not filled to this level water stands on top of the sand. Unloading is done by the reverse process, water being admitted beneath the bins through a suction gallery into which the sand is allowed to drop through controlled gates. The discharge into the fill is made through pipe lines as with the usual type of hydraulic dredge.

All the shore lines of the newly made land will be formed by bulkheads to retain the fill. The bulkheads are generally of the so-called "pile pier" type consisting of two rows of closely driven piling with wales and tie rods, varied in detail according to conditions, filled between with quarry run stone. Details differ in various portions of the work as the finish of the shore line varies. At some points retaining walls will be built on the bulkheads, at other points, low concrete docks for boat landings, at still others there will be paved beaches extending down to the waterline, or riprapped banks, rocky promontories, etc. Where walls, concrete docks or pavements are supported on the bulkheads a line of Wakefield sheeting is incorporated in the structure to more effectively prevent leakage of earth or sand filling through the bulkhead.

Untreated piles and timber are used, as the plans call for cutting down all woodwork to near water level when finished. Temporarily, to retain the fill, the piling and stone fill is left at an elevation five feet above low water. Large blocks of rough stone, not less than one cubic yard in size, are used to top off the stone fill within the bulkhead. They will be removed and readjusted to the final grade or used elsewhere as the shore line receives its final finish. Banks of heavy riprap stone are used to reinforce the piling at exposed points and where the bottom of the lake is soft.

The piles vary in length from thirty-five to fifty feet according to depth of water and other conditions. Where the depth of water is sixteen feet or more the bed of the lake is generally clay, which grows gradually stiffer and harder until hard-pans or boulders are reached overlying solid rock at a depth of from seventy to ninety feet. Sand lies along the undisturbed shore lines above sixteen feet depth of water. The conditions vary according to location, some very soft clay streaks being encountered in places, while in others, particularly between Thirty-ninth and Fiftieth streets, reefs of rock rise to near the bed of the lake. At such places it is necessary to change the type of bulkhead to cribs or stone mounds. Many suggested designs for bulkheads involving the use of concrete piles, steel sheeting, concrete caissons, etc., have been examined, but nothing yet has been de-

(Continued on page 116)

# CENTRIFUGAL PUMP EFFICIENCY

**By L. G. L. THOMAS**

***Vice President and Chief Engineer, Economy Pumping Machinery Company***

AFTER a long period of development, the centrifugal pump has come into general use for practically all services in the power plant, industrial establishment, water works and building. Frequently it is substituted for a positive pump without the pump user becoming thoroughly acquainted with the difference between the positive characteristic and the centrifugal characteristic. The result is often an unnecessary expenditure of power which is responsible for the idea that the centrifugal pump is less efficient than the positive pump.

The positive pump has a capacity which is directly proportional to the speed at which it is run. Its discharge pressure is only limited by its mechanical strength while the efficiency of the pump is practically the same over a wide range of speed and pressure conditions. As a result of this simple characteristic, the positive pump user bought his pumps under very vague specifications. In most cases, it was standard practice to purchase the pump very much larger than was necessary. The speed could then be reduced in order to increase the life of the apparatus.

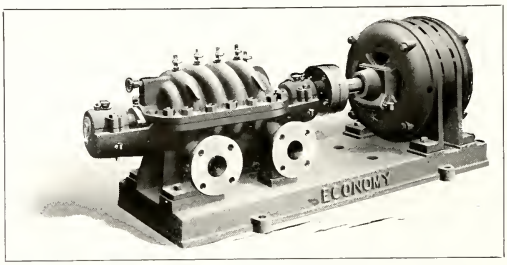
A brief consideration of the action of the centrifugal pump will show us that it must be selected very much more carefully if efficient operation is to be secured. The centrifugal pump discharges its water by whirling it from a wheel or impeller having a peripheral velocity approximately determined by the old law

$$V = \sqrt{2gh}$$

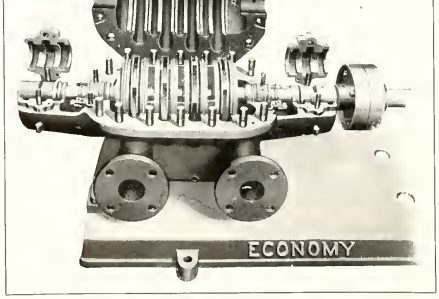
in which $V$ is the velocity of the impeller and $h$ is the head against which the water is to be delivered; in other words, in order to raise water to a certain height with a centrifugal pump we must give that water a velocity equal to that which it would attain in falling from the same height. It is readily seen that if the head on the pump is increased above the amount

$$h = V^2/2g$$

the pump will no longer discharge any water but will merely sustain a column of water of the height $H$ in the discharge pipe. If, therefore, we are selecting a centrifugal pump for a given duty we must make sure that the pump impeller rotates at a speed sufficient to lift the water to the desired height. On the other hand, if the water is given a velocity very much in excess of that required for the given head, a considerable amount of power will be lost within the pump. This is a more serious matter than we might imagine it to be.



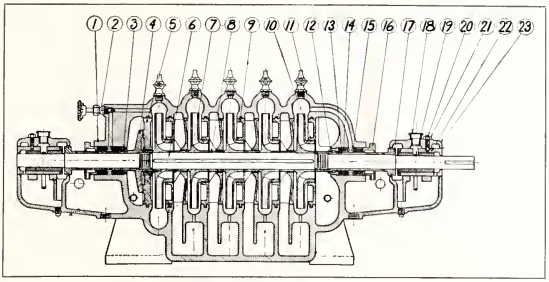

Exterior view of a multi-stage centrifugal pump direct-connected to an electric motor.




Multi-stage centrifugal pump with cover raised to show impellers.

The writer was recently called into a very modern industrial establishment where they were pumping approximately 1500 gallons of water per minute against a head of 22 feet. They were using approximately 105 horse power. The efficiency of their pump installation was about 8%, yet it could not be said that the pump alone was to be blamed. It had been purchased for sewage work and was intended to be run by a steam engine at a very low speed. The mistake was made in taking it out of the equipment morgue for use on the water job. The installation had been made some time before the plant engineer discovered the power consumption. A high speed 8" double suction centrifugal pump driven by a 15 horse power motor was then substituted—this effecting a saving of 90 horse power. The saving of money for a year amounted to $8200.00, which is a very liberal return on the investment in the new pump and motor of only $1000.00.

In another case, a hotel building was circulating brine with a multi-stage pump driven by a 7½ horse power motor. The cost of operation with power purchased from the local Public Service Company amounted to $360.00 per month. The initial investment in pump and motor had amounted to about $600.00. A very careful survey of the piping system made it possible to substitute a single stage pump driven by a 3 horse power motor, with an operating cost of approximately $125.00 a month. In this instance, the saving in a single month exceeded the initial cost of the new equipment, which was only $200.00. Both pumps were of the same make and of approximately the same operating efficiency but the orig-



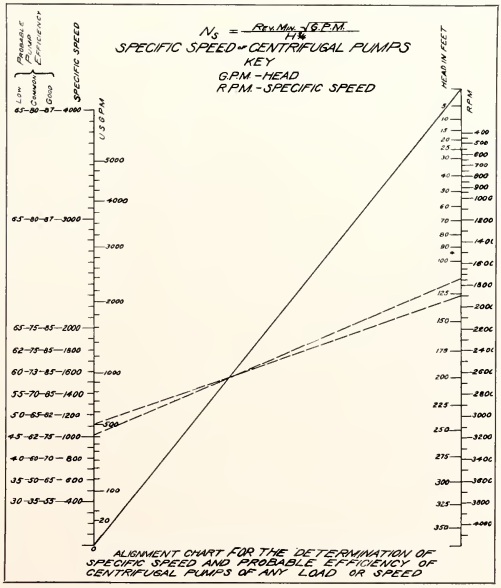

Cross section of a multi-stage centrifugal pump. Numbers refer to integral parts of the machine.

inal multi-stage pump has been purchased very much larger than necessary and was operating at a fraction of its normal capacity at all times. It was a typical case of undue anxiety on the part of the hotel proprietor to provide enough pump capacity. Fortunately, this particular pump and motor were on a separate electric meter so that the operating cost could very easily be determined every month. If the plant had a large number of motors operating from the same meter, the power loss in the pump would probably have not been noticed, and the unnecessary expenditure of $235.00 per month would have continued indefinitely.

It must not be assumed that it is desirable to undersize pumping equipment, but too often the tendency is to provide equipment too large rather than too small. If additional capacity is desired for future expansion the manufacturer can always furnish a pump in which larger impellers can be installed at some future date. The saving in power if a smaller pump is used will frequently equal in one month the cost of a whole new rotating element.

It is the practice of many purchasers to approximate their working conditions and then to attach the greatest importance to the manufacturers efficiency guarantee. As a matter of fact, pump efficiency means nothing unless the static head, pipe function, and water quantity are accurately determined.

Let us consider a method of pump selection which will insure economical results. Figure 1 shows characteristic curves of two pumps having identical efficiency curves; both of these pumps were under consideration for a job where it was desired to discharge 1050 gallons per minute through 300 feet of 6" pipe against a static head of 40 feet. The purchaser had computed his pipe friction and had decided that he would order a pump having a capacity of 1200 gallons per minute against a head of 95 feet. This would give him quite a liberal factor of safety. Performance curves were submitted on pumps under consideration and the static head of 40 feet drawn horizontally on the curve sheet. The friction head for the various quantities flowing through 300 feet of 6" pipes was then added to this 40 foot static head and the curve of the dynamic head plotted. The intersection of this dynamic head curve with the pump characteristics curve gave the actual operating condition for whichever pump might be selected. Both pumps under consideration were of the same make and had practically the same efficiency. Pump No. 2 would discharge 1050 gallons per minute with a power input of 25 horsepower, while pump No. 1 would discharge 1225 gallons per minute with a power input of 34.3, an addition of 37% in power for 16% additional capacity. An investigation showed the smaller pump to have ample capacity. Suppose now that the engineer had purchased the larger pump. His pump efficiency is 85% but the pipe friction must be regarded as a loss outside of the pump so that in figuring efficiency of the installation, the static head alone can be considered. In one case he is handling 1050 gallons at 40 feet at 25 horsepower for an overall efficiency of 42½% while in the other case he is handling 200 gallons at 40 feet at 34.3 horsepower for an overall efficiency of 35.3%.




Now suppose that the pipe size be increased to eight inches and the dynamic head for the eight inch pipe be plotted on the same curve sheet. The pipe friction would then be 9.6 feet for a capacity of 1050 gallons. This would intersect the head capacity curve of a third pump which has an efficiency of only 68%. Yet the horse power would be reduced to 19.5 giving as an overall efficiency of 55% which is higher than that obtained with either of the pumps having an 85% efficiency.

In the above we have talked about the losses which occur outside of the pump. These losses tend to nullify any attempt which the designer has made toward higher efficiency. They do not occur very often in the well designed

plant. It is here that the pump designer has the opportunity to show how cheaply water can be handled.

The efficiency of a well designed pump may be only 50% depending upon the head, the capacity, and the speed. The relationship between these variables is represented by a quantity known as the specific speed which is written as follows:

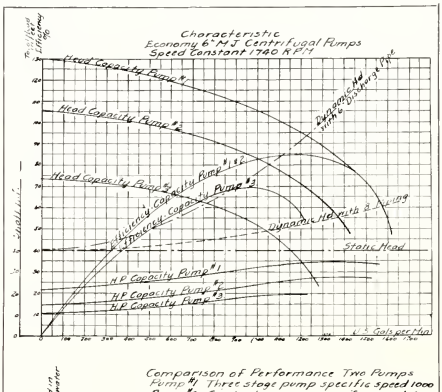
$$NS = \frac{RPM_1 \ GPM}{H^{3/4}}$$

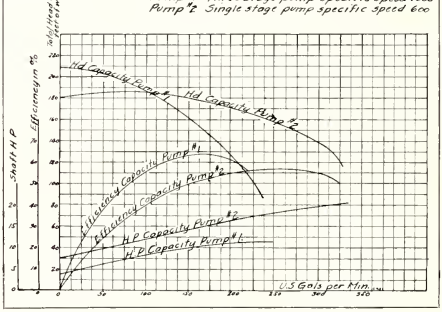
$NS$=Specific Speed
$RPM$=Revolutions per minute
$GPM$=Gallons per minute
$H$=Total head in feet of water

Pump efficiency is represented frequently as a function of the specific speed but the writer prefers to consider both the specific speed and capacity. For instance, a pump having a capacity of 160 $GPM$ at 55 feet at 1750 $RPM$ has a specific speed of 1000 which is a favorable figure. It requires, however, very careful designing to obtain an efficiency of 62% for this capacity although a pump having a capacity of 500 $GPM$ at 130 feet at 1750 $RPM$ might give an efficiency of 75%, the specific speed being the same in both cases.

The accompanying alignment chart covers the solution of the specific speed equation. At the left hand, there is shown the probable range of efficiencies which may be expected of pumps of different specific speeds. There is a very marked tendency for the efficiency to increase with the specific speed. It should be noticed however that, as the specific speed increases above 1600, the efficiency rises slowly, while the problems of design increase very rapidly. It is impossible to make a pump of small capacity having a high specific speed because the rotating speed would be too great for commercial motors and because of the difficulty of designing impellers with the proper inlet. The determination of the most desirable specific speed for any particular job should be left to the pump manufacturer but the customer should see that the specific speed selected is one at which it is possible to secure a good efficiency without excessively increasing the cost of the apparatus.

It may seem that this matter of specific speed is one which concerns only the pump designer, but unless the plant engineer thoroughly understands the factors governing pump efficiency he will have great difficulty in securing apparatus of uniformly high efficiency. He must understand that a pump having a specific speed of say, 400 should have an efficiency of 80-85% while another pump having a specific speed of 800 cannot be expected to exceed 60-70% efficiency. He must also understand the possibility of increasing the specific speed for any given capacity by using a series or multi-stage pump.




Above—Fig. 1 and below—Fig. 2.
Curves showing characteristics and performances of various centrifugal pumps.

One of the most valuable features of the centrifugal pump is its ability to utilize the full amount of any pressure exerted in its suction. For instance, if a pump is designed to operate against a pressure of 50 pounds per square inch and the water entering the pump be under a pressure of 60 pounds per square inch, then the pressure at the pump discharge will be 50 plus 60 equals 110 pounds per square inch. It can readily be seen that if it is desired to discharge against a pressure which would be excessive for a single impeller it is only necessary to connect a sufficient number of impellers or pumps in series so that the sum of the pressures developed by the pumps equals the desired pressure. Ordinarily, when high pressures are required, they are secured by means of a number of impellers in series within a single housing.

The use of the series or multi-stage pumps enables us to secure favorable specific speeds for high pressures. For instance, a single stage pump handling 500 gallons a minute against a head of 220 feet at 1750 $RPM$ would have a specific speed of 690 with an efficiency ranging from 56-67%, while a 3 stage pump for the same conditions would have a specific speed of 1570 with an efficiency range of 60-85%. (It should be noted here that multi-stage pumps never attain the efficiency of a single stage pump of the same specific speed. This is because of the abrupt changes of direction and velocity of water between stages. The probable efficiency of the 3 stage pump mentioned would be 65-75%.) Figure 2 will show the difference in characteristic between a single stage pump having a specific speed of 600 and a small-multi stage pump having a specific speed of 1000. The multi-stage pump has a much higher efficiency even though its capacity is much smaller than that of the single stage pump. Its efficiency of 63% is exceptional for a pump of this size although a single stage pump of the same specific speed and larger capacity might be expected to reach 75% efficiency.

When the head against which it is desired to pump is 200 feet or less it is often difficult to decide between the single stage and the multi-stage pump. It must be remembered that the cost of the multi-stage pump will greatly exceed that of the single stage pump while its efficiency will not be as high as that of the single stage pump having the same specific speed. It is for this reason that many multi-stage pumps designed for too high a pressure per stage show little

(Continued on page 116)

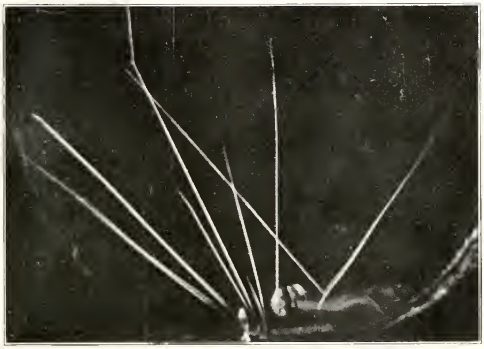
# RADIOACTIVITY AND ATOMIC STRUCTURE

*By* J. S. THOMPSON

*Instructor in Physics*

TOWARD the close of the last century, the science of physics was thought by many to be a closed book. It was predicted at that time that any further development would be in the refinement of methods and the precision of observations. Mechanics, based on the laws of Newton, satisfactorily accounted for the motions of our heavenly bodies as well as mechanical systems dealt with on earth insofar as mathematical analysis was capable of handling the problems. Electricity and magnetism, developed by Faraday, Maxwell and others treated the electric current as the uniform flow of a fluid not clearly defined but thought of as something entirely apart from ordinary matter; the fluid at rest gave rise to electrostatic phenomena. This treatment together with the well known mutual relations between the electric and magnetic circuits was sufficient to interpret the phenomena known at that time, and except in point of design the electromagnetic machinery of thirty year ago was fundamentally the same as that of today, provided we omit some of the modern instruments which depend on the motion of electrons, such as the oscillograph and the thermionic valve. The theory of heat, thermodynamics and the dynamical theory of gases were quite fully developed and their predictions of experimental results gratifying enough. The principles of optics and the interpretation of light and radiant heat as transverse periodic oscillations of a combined electric and magnetic field in a medium called the ether were successfully applied to the known phenomena. And so in other fields of physics the principles upon which the description and interpretation of results rested seemed well established and fairly complete. There were of course stumbling blocks but no more than are encountered in most theories. For example, the actual mechanism of the production of the electromagnetic wave and the manner of emission from spectrum sources of a series of vibrations of definite frequencies characteristic of the source and revealed as lines in the spectroscope were at that time of difficult interpretation.

This study of spectrum lines and their interpretation has offered much information on the question of the origin of light and the structure of the atoms producing it but this development, as well as advances made in other branches of physics, had its beginning and its inspiration in the remarkable discoveries made in 1895 and 1896, namely of X-rays and radioactivity.



Alpha ray tracks in air photographed by cloud expansion method. Collision is shown in sharp bend near end of path.

Just as no single invention or discovery may be wholly attributed to one man, so we find that the study of radioactivity has been aided and abetted through investigation of X-rays, positive rays, and cathode rays. The results have led primarily to a new interpretation of electricity, magnetism, and related phenomena based on the unit of negative charge, the electron; and finally have offered at least a partial solution to the age old problem of the physicist—namely, the structure of matter.

These new conceptions penetrate every field of physics. For a brief example, out of the study of the swift moving electrons or beta particles from radium has grown the special theory of relativity. In turn our older ideas of mechanics have been modified. Radioactivity has placed in the hands of scientists an automatic and almost continuous source of energy. It is of such magnitude that up to the present time it has been impossible to obtain its equal in the laboratory by artificial means; expressed in volts necessary to produce the equivalent effect, this energy of the gamma radiation from radium would require over two million volts. The highest voltage at which an electron tube has been operated (the Coolidge cathode ray tube) is of the order of 350,000 volts. This energy is released during the actual disruption of the radioactive atom and, while we may study this process and use it as best we may, we are powerless to control it.

For the most part, the science of chemistry has been based on the idea of a discreet or atomic structure. To picture the atom as the smallest indivisible unit of an element is the most satisfactory interpretation of the laws of multiple proportions. The molecule then is simply a group of one or more atoms bound together in some definite and usually stable manner determined by the element or compound dealt with. They form the units dealt with in the kinetic theory of gases and in Brownian movements, two of the most striking illustrations of the molecular structure of gases and liquids. More recently the use of crystals as diffraction gratings in the study of X-rays and gamma rays has further confirmed this discreet structure of solid matter. Here the rows of atoms, orderly arranged in a definite space lattice work, act as diffracting centers for the X and gamma rays in the same way as the spaces between the ruled lines in an ordinary diffraction grating act in the case of ordinary light forming a similar spectrum. Whereas, in our ordinary grating we may have ten thousand lines to the centimeter, in a crystal of rock salt we may find a crystal plane having about one hundred million rows of atoms to the centimeter. This study of the crystalline diffraction of X-rays allows us to picture the structure and arrangement

of the atoms making up the crystal.

This atomicity of structure has been extended to the case of electric charges; any quantity of charge being built up from an integral multiple of the elementary unit of charge, the electron. In 1881, Helmholtz first suggested that electricity instead of being a continuous fluid, consisted of discreet charges. These charges at rest behaved experimentally as static electricity and in motion under the influence of a field of force constituted the current flow, each electron contributing its elementary current depending on its velocity and carrying with it its magnetic field. This interpretation grew out of Faraday's laws of electrolysis which established a definite ratio of the total quantity of current flowing through an electrolyte to the substance liberated at the negative electrode. In the electrolysis of dilute sulphuric acid we always find;

$E/M_h = 96{,}500$ coulombs per gram, or that 96,500 coulombs of electricity are required to liberate a quantity of hydrogen equal to its atomic weight (neglecting the .008). Thus we may picture the molecules in the electrolytic solution as dissociated by the water into atoms or atom combinations ($SO_4$), each atom or combination carrying attached to it a plus or minus charge. These charged atoms or groups of atoms are termed ions and the motion of the ions under the electric field produces the current. Thus let us suppose that each ion carries a charge $e$: then in our case, since one gram of hydrogen has been conveyed, we shall have for the total quantity of electricity carried,

$$E = Ne$$

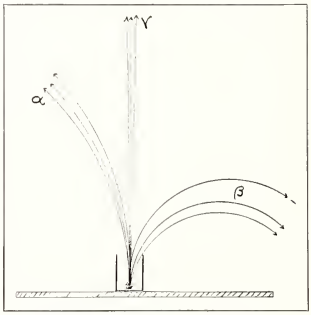
where $N$ is the number of atoms in one gram of hydrogen, and $e$ the elementary charge attached to the hydrogen atom in solution. The number $N$ as found from kinetic theory of gases and other sources is approximately $6 \times 10^{23}$ atoms; $M_h = 1$. We have then,

$E/M_h = Ne/1 = 9650$ c.g.s. electromagnetic units.

Solving for $e$ we find,

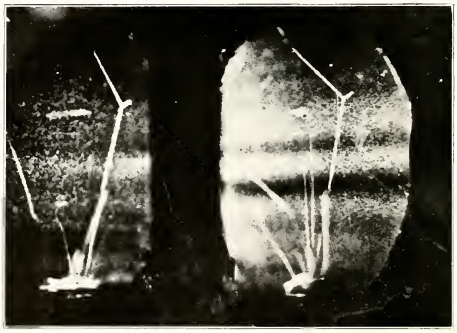
$e = 1.6 \times 10^{-20}$ electromagnetic units
$= 4.77 \times 10^{-10}$ electrostatic units.

This value of $e$ appears to be the elementary unit of electricity insomuch as a smaller quantity has not been detected and all charges seem to be integral multiples of this unit. The value of $e$ has been very accurately determined from thousands of observations of the motion of electrons attached to minute oil drops and travelling in an electric field.



Diagrammatic illustration of paths described by alpha, beta, and gamma rays moving in magnetic field.

In its manifestation as attached to the ion carriers in electrolysis, the electron did not exist independently but made itself known by attaching itself to a neutral atom; or in the case of hydrogen, by removing itself and leaving an equal positive charge. This same unit of negative electricity has been found to exist independently in the form of the cathode rays from the ordinary discharge tube and from hot filaments. When an induction coil or transformer source of potential is applied across the terminals of a discharge tube or Coolidge tube and the gas pressure reduced, a series of characteristic changes take place. At a pressure of below one fiftieth of a millimeter of mercury, a greenish fluorescence is observed on the walls of the tube which seems to originate at the negative terminal. In the study of this fluorescence, which was at first thought to be a new form of radiant matter, it has been shown that the phenomena is due to streams of negatively charged corpuscles travelling at high velocities. These particles were repelled from the negative terminal of the tube and their velocities depended on the potential applied. From their origin they were termed cathode rays.


TRACKS IN ARGON.
The short track is the path of the heavier argon nucleus while the longer is the path of the deviated alpha ray.

The corpuscles were found to proceed in straight lines from the source, to cast shadows, and were shown to possess momentum by allowing them to set a small paddle wheel in motion by their impacts. In a magnetic field, the stream acted exactly as a flexible current, being bent into circles perpendicular to the field and obeying all the laws of ordinary currents. In fact, the motion of these tiny bodies is one of the most beautiful confirmations of the laws of mechanics.

We may suspect by now that this stream of corpuscles is made up of the same electrons found in electrolysis, each charge being equal to that unit found attached to the ion carriers. The quantitative evidence which will help settle this point and serve to identify the electron under varying conditions is the determination of the ratio of its charge to its mass or *specific charge*. In the same way as the motion of a neutral mass depends on the forces acting upon it, as in a gravitational field, the motion of the electron depends both upon its charge and mass. The specific charge, $e/m$, is determined by measuring the deflection of the electron stream in a magnetic field, the electrons possessing a definite velocity acquired by falling through a constant potential. Its derivation depends only upon Newton's laws of mechanics and the motion of currents in magnetic fields so that we may express the ratio in terms of measurable quantities. The expression for this ratio has been found to be

$$e/m = 2V/H^2r^2$$

for small velocities in comparison with the velocity of light. Here $V$ is the potential through which the electrons fall, $H$ the magnetic field, and $r$ the radius of the circle into which the stream is bent when travelling perpendicular to the field. Thus for electrons;

$e/m = 1.769 \times 10^7$ electromagnetic units per gram.

We have determined for hydrogen ion, $Ne/Nm_h = e/m_h = 9650$ e.g.s. electromagnetic units per gram.

Dividing we have, $m_h/m = 1800$ approximately. In other words, the mass of the electron is 1/1800 of the mass of the lightest known atom, that of hydrogen, or about $10^{-27}$ grams.

Tracks in air. The collision is shown near the end of the path in the sharp bend.

Coincident with the study of cathode ray electrons came the study of X-rays. The extremely short light rays were first detected originating in the walls of the discharge tube in the neighborhood of the greenish fluorescence. They are now known to be due to the sudden stoppage of the electrons by matter, their nature depending on the material bombarded or anticathode. It may be shown that an accelerated electron will emit an electromagnetic radiation similar in every respect to that of light. The bombardment of the anticathode will then give rise to a continuous X-ray spectrum somewhat similar to white light superimposed upon which will be the characteristic X-ray line spectrum of the element composing the anticathode. The study of X-rays has given rise, through Moseley's law, to a new interpretation of the periodic table based on the more fundamental atomic number rather than on the atomic weight, the atomic number being given from the characteristic X-ray spectra. Conversely, when X-rays strike matter, they eject electrons of velocities depending on the frequency of the impinging ray. This reversal is known as the photoelectric effect and its effect is also prominent when ultraviolet light is incident on metals, this forming the basis of the transmission of pictures by wire, the intensities of the electron emission depending on the intensity of the light and vice versa.

In addition to these sources of electrons, we find them emitted by hot filaments of incandescent lamps and radio tubes, by radioactive substances, and freely migrating in gases and metals. In all of these cases the electrons are identical in charge and they probably are in structure although very little is known of the volume or size of the electron or what prevents it from exploding. Also these things are entirely independent of the method of production; in other words the same value of $e/m$ is found for all known elements and compounds constituting our electrodes and filaments, the various sources differing only in the richness of the electron stream. From this invariance of $e/m$, it may be safely concluded that the electron is a universal constituent of all matter.

Since ordinary matter is electrically neutral, it now becomes necessary to discover a unit of positive electricity equal and opposite to the electronic charge. This search had its beginning in 1886 with the discovery of positive or canal rays. These rays run backwards in the discharge tube in the opposite direction to the cathode rays; being repelled from the anode. If the cathode is pierced with a small hole (canal) these particles will pass through and may be studied in the region of the tube behind the cathode. They were found to consist of positively charged particles from the direction of their deflection in a magnetic field; the deflection being in an opposite sense to that of the electrons. In other words these canal rays form a positive current and the ratio $e/m$ describes them as individuals in exactly the same way as the $e/m$ for electrons. These particles are much more massive and travel with correspondingly lower velocities. Many experiments with these rays reveal the unit positive charge as that of the hydrogen nucleus, equal and opposite to the electron charge $e$. This positive unit has been termed the *proton*.

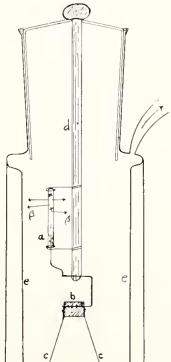
We now have what appears to be the working elements with which to construct our atoms of ordinary matter, those such as exist in crystals, enter into chemical combination, and make up our well known elements and compounds. The universality of the electron and the existence of the complimentary proton gives us the necessary if not sufficient building blocks with which to construct the atom. Various atomic models were attempted after the establishment of the electron but it remained for Rutherford and Bohr to construct the most successful working model. Their success may be traced directly to the interpretation of the new phenomena presented by radioactivity and the newer quantum theory. Radioactivity has been both the

(Continued on page 97)

## RADIUM CLOCK

*A striking illustration of the properties of radium is shown in the operation of the radium clock recently constructed at the Radium Institute of Chicago. This clock was originally devised by Strutt in England.*

*The radium salt in the form of the bromide is contained in the thin walled glass tube* a. *The radium emanation is in equilibrium with the radium within the tube so that the active deposit formed on the inner walls is a source of alpha, beta, and gamma rays. The thin walls of the tube allow the gamma rays to escape and a large proportion of the beta rays. Sealed into the tube is a platinum wire which is also in contact with the gold leaf support* b. *The gold leaf system and radium source are all insulated from the case by means of the glass rod* d *which is sealed into the ground glass stopper of the tube. The large tube containing the gold leaf and radium system is made conducting by means of a chemical deposit of silver, a small window serving to observe the leaves. An aluminum sheath* e *is mounted on opposite sides of the gold leaves and is in metallic contact with the case. The whole apparatus is pumped out carefully to as low a vacuum as possible and sealed.*




The Radium Clock.

*In operation, the beta rays are ejected from the radium tube, leaving a net positive charge within the tube which is transmitted to the gold leaf system* c-c. *The leaves diverge at a rate depending on the rate of emission of the beta particles until they are discharged from contact with the sheath* e. *The leaves then collapse and the process is repeated and will continue indefinitely as long as the beta rays are emitted. The period will, however, slowly increase and should double in a period of 1800 years, the half life of radium. A good vacuum should be maintained to prevent ionization of the air by the gamma rays and hence the leaking off of the charge before the leaves are able to diverge. With approximately 4 milligrams of radium the period may be made about 25 seconds.*

# A RESEARCH UNIT IN THE BOOK PAPER INDUSTRY

*By* D. E. CABLE, '18

*Assistant Director, Research Department of the Oxford Company*

THE importance of scientific and industrial research is of such a nature at the present time that it is commanding the attention of bankers and industrial executives in a very active way. Hugh Farrel, Financial Editor of the *New York Commercial*, has, during the past year, published a book entitled *What Price Progress*, which is likely to render a service of inestimable value to American industries in particular and the general public indirectly by calling attention to the economic hazard of any industry doing business without the assistance of a certain amount of fundamental or at least developmental research.

In order to impress on the reader the vital significance of research to the life of an industry it is well worth while to quote a few passages taken from various parts of this book by Farrel:

"There is no industry—not one, that is not in danger of waking up tomorrow and finding that the chemist has made a discovery that might revolutionize it.

"The investor whose money is really in danger is the investor who has put his savings into industries which are not keeping up with the times in the matter of new processes and methods of manufacture of fundamental resources.

"The investor may feel that a bird in the hand is worth two in the bush and be so much more anxious for the extra dividend he might get if his company's funds were not paid out in that way than he is concerned over the security of his principal that the managers of his company hesitate to spend the money on research.

"Yet the average investor knows that the first principle of sound investment is security of principal. That principle of investment is hammered into the investor from every side. No industry which does not command the services of chemists and the resources of laboratories can be regarded as secure."

As far back as 1920, American industries were fortified with approximately 300 research units. These units were manned and financed by as many individual companies. The size of these units varied at that time from one or two men to a staff of 1188 employees, including 401 graduate chemists and engineers.

At that time the paper industry was represented with approximately ten research units, the largest of which employed a working force of 22 chemical engineers and 17 works chemists.

View of laboratory showing double compartment hood, chemistry table, and desks.

This article is written with the idea of rendering some assistance to others in the book, or related branches of the paper industry, who might be called upon in the future to organize and maintain a research department which can be a real asset to any company it is designed to serve. The contents of this article will be limited to a description of the mechanism and certain policies of a young and growing research department with which the writer has had the privilege of being associated for nearly three years.

This department, because of its youth, has without doubt many faults which will require years of experience and stabilizing maturity to remedy or eliminate. However, at this early stage of its growth it appears to have certain virtues which might with propriety be cultivated and fostered in the future infant research units of the book paper industry and even in other families of the paper industry such as producers of kraft, bag or wrapping papers, bond or writing papers, greaseproof tissues, newsprint and wall papers.

At present the personnel of this department totals fourteen men. The Director holds a professorial chair in one of the metropolitan universities and is particularly experienced in the direction of chemical or applied research. Serving as co-operating botanist, we have the Director of Laboratories of the New York Botanical Garden. Of the other workers, eight are college graduates with major training in chemistry, chemical engineering or wood technology and three have taken high school courses in chemistry. Research work normally demands men who possess initiative, resourcefulness, skill in laboratory technique, and patience. We believe that half a dozen men of outstanding ability along these lines will accomplish far more good than a hundred college trained men of average or mediocre intellect and technical skill.

Since the Oxford Paper Company is engaged in the manufacture of soda and sulphite pulps, electrolytic bleach and caustic soda, book, magazine, envelope, lithograph and coated papers, the research department is expected to cope with almost any type of problem which might arise in connection with these various intermediate and finished products. Anyone familiar with the technology of paper manufacture will realize that the number of such problems which arise in a normal mill, producing over three hundred tons of paper a day, is multitudinous.

For the present, it is our policy to take up only those problems which appear to be of most urgent or economic importance. Naturally the larger part of those problems are developmental in character, but there are some which are far more fundamental in nature.

Since the very inception of this research unit a problem of major import-

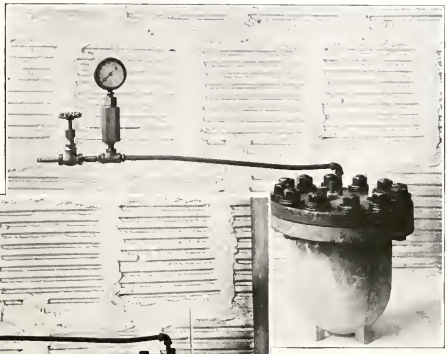
ance with us has been an intensive investigation of how to raise and harvest forest trees of the poplar type, economically, in order to assure a continuous supply of short fibered wood which is being consumed by our soda mill at the rate of approximately three hundred cords a day. For this work on tree breeding and cultivation, nurseries are operated in New York and Maine. This problem is being studied in co-operation with the New York Botanical Garden.

The laboratory being located in Brooklyn, all our laboratory men have easy access to the vast wealth of technical literature on hand at the New York Public Library and the library of the Chemists' Club. This is a consideration of prime importance for a research laboratory though it is of secondary importance to a mill control laboratory.

A further advantage in the location is the close proximity to large local laboratory supply houses. This assures quick purchase and delivery of specialized apparatus which in research work is often wanted unexpectedly. We find it convenient to interview personally the New York agents of paper mill machinery or equipment — a consideration of no small degree in developmental research. Another benefit from the present location is the fact that our chemists and technical men have the inspirational advantage of easily attending the annual conventions of the Technical Association of the Pulp and Paper Industry, the frequent meetings at the Chemists' Club and the occasional technical expositions which are held every few months at the Grand Central Palace.

Our experimental method of conducting sulphite cooks has been described in detail in the *Paper Trade Journal* of April 23, 1925. Accompanying photographs show the cooking apparatus used. Dozens and dozens of experimental sulphite cooks have been made in this apparatus during the past two years, using wood chips of spruce, balsam fir, hemlock, jack pine, longleaf pine, western yellow pine, aspen, maple and birch. All this work has been highly quantitative. Quantitative data in cooking 65 gram quantities of sound spruce chips agrees remarkably well with the data obtained by Miller and Swanson at the U. S. Forest Products Laboratory in their 100 pound experimental spruce sulphite cooks.

This surprising confirmation of results together with our ability to reproduce closely our own results with this small apparatus leads us to place in such experimental work a considerable amount of confidence. The assembled sulphite autoclave or digester is placed inside a large Freas oven (electrically heated). The relief pipe projects through the side vent hole and the pressure gauge with oil seal and needle valve are attached (outside of oven) to the relief pipe after the digester is placed in the oven and the end of the relief pipe is pushed through the vent hole.



Above—Sulphite digester assembled in Freas electric oven.
Below—Sulphite digester (not assembled) and glass bottles, containing wood chips, which are to be placed in it to be cooked.

From this point on, the temperature within the digester is controlled thermostatically by controlling the temperature of the air in the oven which surrounds the digester. The pressure within the digester is controlled by means of the needle valve at the end of the relief pipe. In this way we are able to reproduce all temperature, pressure, and time conditions which would accompany a commercial sulphite cook of any size.

There is one department of the laboratory which deserves particular mention and that is the library. In this library we have about as complete a set of books as possible on all phases of pulp and paper manufacture, laboratory technique, chemical and mechanical handbooks, forestry and silviculture—in short, books directly or remotely related to any problem on which we are engaged or have been engaged. This library has complete sets of the Chemical Abstracts (Journal) and the Journal of Industrial and Engineering Chemistry and a set of the Journal of the American Chemical Society which is complete as far back as Volume 20 (1898). In addition to these journals we are receiving regularly eight American and Canadian, two English, one French, one Swedish and three German technical periodicals of interest to the pulp and paper industry. All copies of these journals are retained at the laboratory and at the expiration of each year they are bound up in volume form to guard against loss of individual issues.

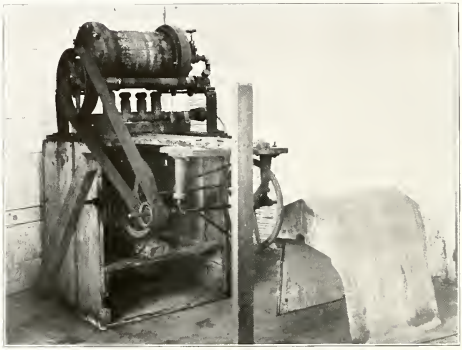
Another very important and useful tool in our research department is our file of patents and technical abstracts. Our policy from the very start in making a literature search on any problem or subject in which we are specially interested has been for the man who makes such a search to write and type an abstract of each article or reference he has read. These abstracts are written according to a certain standard form on letter size paper with the subject of the article at the top, followed by the author's name, the name of the journal, volume number, page numbers and date of the article. A filing number is placed near the top of each abstract.

Every abstract is typed at least in triplicate—the original copy being kept in one of our filing cases under lock and key, another copy is kept on file at the New York office of our company, and the third copy is kept as a working copy (still the property of the company) by

the man responsible for working up the literature on his problem or on a special subject assigned to him. Each man in charge of a project or problem is responsible for seeing that he and the department are provided with abstracts of all articles, bearing on his subject.

These abstracts are kept up to date. In reviewing the literature, we depend on three sources of obtaining periodical literature on a given subject—the *Chemical Abstracts*, the abstracts contained in the annual numbers of *Technical Association Papers*, and the *Industrial Arts Index*.

A man doing systematic research should have covered the literature on a given subject fairly well before he does much experimental work along that line. By the time his laboratory work is complete and he is ready to write up his data in the form of a progress or final report, he should have reviewed the literature (domestic and foreign) on his subject in an exhaustive way. An author filing card is on hand for each abstract. An author card bears the title, reference, and filing number as well as the author's name corresponding to the abstract to which it refers. When one is in doubt as to whether a given article has been previously abstracted for the laboratory or not, it takes but a moment to settle the question by examining the file of author cards.



Gas heated rotary iron digester operating at 2½ r.p.m. The capacity is about five pounds.

At the time of writing a progress or final report on a given investigation, it is the duty of the man writing that report to read over all his related abstracts. These abstracts often serve as a convenient means of preparing an historical introduction to a technical report.

It would be a hopelessly long task to describe in detail all the problems which have been studied in our research department during the short period of its existence. More good would come from telling in a brief way how we would handle a typical problem, relating to a study of the pulping characteristics of a given wood. Such problems have occupied the major portion of our time during the past two years.

Let us say that some authentic information is wanted, regarding the pulping characteristics of white spruce, *Picea canadensis*, and balsam fir, *Abies balsamea*, growing on Cape Breton Island, Nova Scotia.

Our first step would be to request one of our wood technologists, familiar with the botanical classification of forest trees, to go into one of the stands of pulpwood trees on that island and cut for us four foot logs of each species. One log from each tree and two or more tree specimens for each species would meet our requirements. We would insist, however, that each representative log come from a specified distance above the ground, say that the center of log should be six feet or ten feet above the ground as it stood in the original trunk of the tree. Our representative obtaining these logs for us in the forest would fill out a blank form which calls for specific field data on each log specimen. These form sheets with identifying numbers or marks would be mailed to us at the time the logs are shipped.

On being received, a specimen disk, one inch thick, is cut with a saw from the center of each log. The disk is labeled for identification and is subsequently used for obtaining certain physical and chemical data on the mother wood. Each half log is about two feet in length and, as a rule, from eight to ten inches in diameter. These half logs are marked and split into four or six equal sticks or sector prisms. As many of these sticks as are required in the making of chips are barked, freed of knots or other blemishes, and chipped in our standard manner. The sticks not immediately required for the making of chips are properly labeled and stored in one of the nooks of our log filing rack.

For sulphite cooking we prefer to obtain wood in the form of chips of ¾ inch length, with the grain. The chipper gives chips of remarkably uniform length. The freshly prepared chips are then spread on one or more Fourdrinier wire (80 mesh) covered trays. After leaving these chips stand several days in contact with the air of the room they have decreased in moisture content to values between 5 and 10 per cent, depending upon the relative humidity of the air prevailing at the time the chips are dried. The air dried chips are then transferred after thorough mixing to a covered milk can.

Moisture tests are made on the chips in each can at the time one or more lots of samples are withdrawn for experimental sulphite, soda or sulphate cooks. Having the chips in these fairly tight fitting milk cans minimizes the change in moisture content of the chips due to fluctuating relative humidity conditions in the air of the room.

It would be imposing too much on the good nature of the reader if this article went into further detail, regarding all the steps through which we pass in cooking the wood chips by one of the three commercially important chemical processes. Suffice it to say that ultimately we would arrive at specific information, regarding the yields of bleached or unbleached pulp in pounds per cord for each kind or species of wood studied. We would know approximately the ease with which each pulp could be bleached and the average length and diameter of individual pulp fibers. There are numerous other facts which we would learn from this work, but these are doubtlessly the ones of major interest to the pulp or paper manufacturer.

Assuming that all the experimental data required has been obtained, it is then the duty of the project leader to present all this data adequately and clearly in a formal report which can be read and understood by men of non-technical training. This report should contain as a general rule a fairly clear picture of all work done on the subject up to that time by other investigators. The introduction and this historical review would then be followed by a clear cut picture of the experimental work of the present investigators together with a clear and concise statement as to their conclusions. This latter picture calls for the skill and spirit of an artist in outlining or planning the scope of a technical investigation.

*Research work is doomed for failure if it is tackled by technologists of average or poor ability no matter how carefully or conscientiously they may work. They are too liable to drive around in circles and arrive at their destination after painfully long and costly intervals of time.*

## ELECTRICAL ENGINEERING

(*Continued from page 85*)

out new devices and making improvements in many details of standard electrical equipment. They are also studying production methods with the object of reducing costs wherever possible. Some of these methods such as electric welding involve direct electrical applications. All of these efforts in research, design, development, and production afford opportunities for the electrical engineer to apply his knowledge and exercise his ability.

In operating, he may design, construct, or operate electrical systems such as electric generating stations, street railways, communication and transmission systems. As a designer or builder of an electrical system, the electrical engineer generally takes standard parts as produced by the electrical manufacturer and arranges them to suit his particular problem. In this capacity he may act as a consulting engineer or he may be a part of the organization which operates the system after it is built. As an operating engineer, he is charged with the responsibility of having the system function when and as desired with the greatest economy consistent with the quality and quantity of service required. In this position, the engineer is a part of an organization whose mission is to sell a service such as the supplying of electric energy, transportation of freight or passengers, or the means of communication between two or more persons.

In selling electrical equipment, if it is of any magnitude, the salesman must also function as an engineer, for he must know the characteristics of the things he sells and he must also know the demands that the customers will make on these things. He must see to it that what he sells meets the requirements and, very frequently, he must do more engineering in connection with a sale than does the customer to whom he sells.

On the other hand, the customer may be very well informed and it will be up to the salesman to show the customer that his knowledge of the technical and economic features of the device he is selling is equal to or better than that of the customer. The engineer-salesman is a comparatively recent product and nowhere is he needed more than in the electrical field. The manufacturer, desiring to establish a reputation for fair and intelligent dealing, must be represented by salesmen skilled in the art, who can and will assist customers not so well informed to select those things which best suit their needs, and who can also meet highly trained operating engineers on a plane of equality.

What an electrical engineer needs to know is fairly well indicated by what he is called upon to do, but a few particulars may not be out of place. It is immediately evident that his knowledge must contain a central core of facts relative to the principles of electricity and magnetism and their applications. Since electricity is not used apart from matter, a knowledge of mechanics, materials, and machines is essential as a foundation for electrical engineering. As many of the applications of electricity involve the production of heat, light, or sound, a good knowledge of physics is likewise an essential. Other applications, of which welding, electro-plating, and the fixation of atmospheric nitrogen are illustrations, call for a knowledge of chemistry and metallurgy; and to obtain quantitative results in all these, calculations are more or less necessary and here mathematics finds one of its useful applications.

The electrical engineer, in common with others, must appreciate that he can be of service only as a member of organized society. He must know that society, and understand that his work has no value apart from society. He needs to know how to work with as well as for his fellows; tactfully, honestly, and economically. Given a liberal fund of knowledge as indicated, he must possess the resourcefulness and the judgment to use it properly, and the initiative to push his applications to beneficial results.

---

## RADIOACTIVITY

(*Continued from page 93*)

source and the confirmation of the modern theory of the atom.

Radioactivity may be defined briefly as the spontaneous emission of energy in the form of rays. Radioactive substances are found among the heavy elements, the three chief parent elements being uranium, actinium and thorium. There are no other substances which are measurably radioactive with the exception of potassium and rubidium which have been shown to be very weak sources of beta rays; and radioactivity of these elements appearing as a sort of anomaly, neither of them being closely related to the other main sources. The types of rays and processes are similar in all of the chief sources and for this reason the uranium series, in which radium is a member, will be used in discussing the principal radioactive properties.

In 1896, Becquerel of Paris was investigating the fluorescent effect of sunlight on various metallic salts. During the course of his experiments on a salt of uranium the ore used was laid away on a package of photographic plates, wrapped of course in light proof paper. Upon developing these plates, a dark spot appeared on the spot over which the ore had lain. Further experiments showed that the same effect was produced through a thin layer of silver and that it was not due to fluorescence but to a new property of matter exhibited in the uranium which was termed by Becquerel *radioactivity* from the Greek word *radius* or ray.

Some months later in 1898 a strong radioactive substance was discovered in pitchblende and this activity could not be accounted for from the uranium or thorium present. This new radioactive element, radium, was discovered by the Curies and is obtained by separating the barium found in pitchblende, barium being a homologue of radium. Processes for the extraction of radium differ depending on the type of ore worked. In general the radium in the barium is enriched by a series of fractional crystallizations. Metallic radium obtained by electrolysis of a salt solution is a pure white glistening metal resembling freshly cut lead. The property of radioactivity is not dependent on the state of chemical combination, in fact cannot be controlled in any way by any known physical or chemical process, so that the chloride of radium being soluble in water may be conveniently used in illustrating experiments.

The chief sources of radium at the present time are in the carnotite belt of Colorado and in the pitchblende found in Bohemia and the Belgian Congo. To extract a gram of metallic radium from the uranium in the Carnotite ore requires the treatment of 500 tons of ore with 500 tons of chemicals, the use of 1,000 tons of coal and 10,000 tons of water, and the work of 150 men for a month. After the ore is mined, about six months is required to put the radium in its con-

(*Continued on page 112*)

# THE UNOFFICIAL OBSERVER

## By JAMES C. PEEBLES, '04

### A MAN OF INTELLECT

At five o'clock on a Friday afternoon the professor finished the last of the quiz papers which he had been marking and laid it aside, his feelings a strange complex of relief and disappointment. Relief that the task was finished, disappointment that the marks were so poor. "If I could only teach those young men to think," he mused, "I would feel that I had not lived in vain."

During an unoccupied hour earlier in the day the professor had visited the electrical department and despite the growls of the watchful Cerberus who guards the instrument room had succeeded in borrowing a voltmeter, a milliammeter, a Wheatstone bridge, and a coil of wire. These stood on the chair beside his desk, together with a number of neatly wrapped packages which he had brought back from a shopping tour that noon. Closing his desk the professor gathered his *impedimenta* into as portable a bundle as possible, and staggered out into the gathering twilight. A heavy snow storm had ridden into the city that afternoon on the crest of a forty-mile gale, through which he made his way with great difficulty while the snow swirled about him in hissing spirals. He was thankful to find the elevated train less crowded than usual so that he finally reached home with all his bundles intact.

Immediately after dinner he unwrapped his purchases and spread them out on the living room floor. His wife watched with interest as he displayed the newest type of power tube, a "B" battery eliminator, the "makings" of a power amplifier, a wave trap, and a mouse trap. The latter he turned over to friend wife, who had suspected for some time that there were mice in the pantry. The borrowed electrical instruments were also laid out with the others, and the professor, with coat off and sleeves rolled up, and as enthusiastic as a small boy with a new toy, made a frontal attack on an elaborate but inoffensive looking radio which stood in the corner of the room.

Having three nights and two days ahead of him before the duties of his calling would demand his attention once more, he had determined to "rebuild" his radio. He began tentatively, just a change here and there while he noted the effect. Hour after hour he worked while the raging elements outside and the outraged instrument inside matched howl for howl in a cacophonous dust throughout the evening. Finally the patient partner of his *toys and horrors* grew weary of the performance and went upstairs to bed, remarking as she left the room, "Better vaudeville than that is continuous until 11 P. M. only; I've had enough; good night." Still the professor worked on, far into the night, but the visible and audible results of his labors were far from encouraging. The radio looked like the dynamo laboratory after an experiment by the Senior Mechanicals, and sounded like the whistle on the air compressor on Open House night.

Without waiting for breakfast next morning the radio expert resumed his task; the storm of the night before had subsided but now the howls of the radio were matched by a series of shrieks from the kitchen. The professor rushed to the rear of the house, to be confronted with evidence that he had made at least one good buy the day before; the mouse trap was more efficient than the wave trap. After disposing of the captured rodents he returned to his job, hoping that wave trap makers were not mind readers.

For two days the professor worked steadily, scarcely taking time for meals. By Sunday night the rebuilding was finished, and he sat down in his over-stuffed easy chair to enjoy the fruits of his labors. Soon the door bell rang and without turning off the radio the professor went to the door to admit a friend of the family, an old gentleman whose air of culture and quiet dignity seemed to surround him like a kindly aureole. Just then the loud speaker was bawling forth in raucous tones an alleged song which told of the lubricating efficiency of a dropped banana peel in facilitating the return of some recreant shiek to his sugar plum. With a glance of mild surprise the caller looked from the radio to his host and back again to the radio, but the professor quickly turned off the offending instrument and the remainder of the evening was spent in quiet conversation.

About two months before, on the occasion of the professor's birthday anniversary, this old friend of his had presented him with a book, a splendid two-volume work devoted to the story of man on the earth, beginning with the earliest archeological records. The donor had found it an inspiring and thought-provoking book, and he was interested to hear what the professor thought of it. In shame and humiliation the latter had to confess that he had not even begun to read it, and made the usual excuse of lack of time. But when he thought of the hours that he had spent tinkering with his radio or listening to its output, some of it good, much of it banal, he felt just a little guilty. His uneasiness, however, was occasioned, not so much by the thought of the time he had wasted, as by the feeling that he had disappointed a friend, and perhaps had fallen just a little in that friend's esteem.

Monday morning on the elevated train the professor met the pastor of the church which he attended at irregular intervals. The latter expressed regret that he had not seen the professor in church for some time, and hoped that he would soon become more regular in his attendance. "But, Doctor," remarked the backslider, "I can hear you every Sunday morning over the radio; if I don't get out to church I can do the next best thing and listen in."

"Oh, then you have heard our new organ which was installed three months ago; how do you like it?"

For a moment the professor did some faster thinking than he ever did before his classes. Although no poker player the preacher had called his bluff, and he must either admit that he was bluffing and that he seldom listened to the church service, or else be untrue to his dearest possession, his radio. Like a flash he made his decision, "Well, you know, Doctor, organ music doesn't come very well over the radio."

The problem of the professor and his radio is probably no different from that of any other man and this latest toy which science has given us, although one may perhaps be pardoned a mild regret that such should be the case. Among purveyors of entertainment the individual commonly described by the amiable euphemism *tired business man* is well understood and amply provided for. Before the advent of radio he was to be found in the front row at burlesque or vaudeville, forgetting his weariness in the songs and dances of their callipygian charmers. Now the entertainment comes to him in his living room or den; here he spends the entire evening listening to his radio, stretched out at an angle of forty-five degrees in his Coxwell chair or in a horizontal position on the overstuffed davenport. Perhaps he tries to read while he listens with the result that he does neither; he seldom gets beyond the head lines or the sporting page of the evening paper before he is snoozing peacefully, a welcome respite from the strenuous mental activities of the day's business.

With the exception of periodic orgies of "rebuilding" this is an accurate estimate of the radio in the home of the average fan. But is it a pleasant picture of the leisure hours of a man of intellect, one whose calling in life is to teach youth to think? The professor will tell you of the educational and cultural value of the radio, all of which is true. Used in moderation and with discrimination the radio is one of the greatest blessings of modern life, but how many practice this fine virtue of temperance?

With the possible exception of a willing horse, a hobby is the most popular pegasus in the world. Under the almost irresistible urge to ride many a man wraps his legs about the flanks of his hobby, kicks his heels together in gleeful abandon, and charges wildly about in the contemporary scene, while sane men wonder. Is there anything temperate about such a performance? Is there any discrimination or quiet dignity about it? In short, is it a spectacle at all becoming to a man of intellect?

Of course, radio is something new and it seems to have struck the public with the suddenness of a spring flood. All the intellectual bantam-weights have been swept from their moorings and are careening wildly about in a mingled sea of beauty and bilge. It is not at all necessary for one to belong to the heavy-weight division to be able to steer a steady course in this teapot tempe-t. Even as far down as the welter-weight class, just a shade above the average college graduate, sufficient ballast should be found to avoid intellectual shipwreck. In the magic circle about the loud speaker, to what division do we belong?

### LABORATORY LEXICON

*Examination:* For the good student an incident, for the average student a nuisance, for the poor student a tragedy.

*Grade:* A cryptogram in which the student's imperfection is expressed by the professor in terms of his own perfection.

*Engineer:* An industrial and social Uncle Sam who asks nothing for himself —and gets it.

*Drafting Room:* A place of rare imagining where Bobby Make-believe designs engines and boilers that never are, for power plants that couldn't be.

# THE ARMOUR ALUMNUS

## J. WARREN McCAFFREY, '22, *Editor*

### ALUMNI EMPLOYMENT BUREAU HELPS STUDENTS

Since the opening of an alumni office at the Institute a great many applications for positions have been received. Likewise there have been a good many requests for former students received from business houses and firms around in the Central West. A great many of the applicants for positions have been satisfactorily placed and a number of the requests for graduates of the Institute have been satisfactorily fulfilled. It is with a great deal of pleasure we report that the department of industrial relations is now functioning and at the present rate bids fair to be of immense value to the graduates and former students of Armour Institute.

All applications for positions are recorded in the order of their receipt and notice taken of the applicant's qualifications and his preferences for new employment. If there are no requests on file at the time from firms requiring men of the applicant's qualifications, every effort is then made to locate the applicant with a firm suitable to himself. However, in the great majority of cases there are requests on file sufficient in number for the applicant to investigate and even sometimes make a selection. Up to the present there have been considerably more requests for men in various technical lines received by the department than there have been applications from alumni. This fact is proof that as yet the employment bureau is not functioning with the greatest efficiency and service it might were there more applications for positions on record in the department.

The employment bureau was started because there was felt the need of placing graduates and former students in the line of endeavor that their particular training and education best fitted them for. Also, a great number of alumni are in positions to employ technically trained men and it was felt that such a bureau could be of great service to them in securing qualified help. However, the bureau can only approach maximum efficiency and service when it is doing a volume of betterment and help to those looking for positions and those looking for men to fill positions.

It was not the intention when creating the office to selfishly care for the needs of the Alumni Association only. Every effort possible is being made to help those members of the undergraduate body who have signified their desire for part-time employment. Naturally enough, however, it is more difficult to find employment for a student where his program of classes has to receive such vital consideration. The majority of students can only devote a few hours a day, or perhaps a full Saturday, to any employment. Positions measuring up to such restrictions are very few. Accordingly, very few students can be successfully placed in comparison with the number of graduates and former students who are in a position to devote full time. However, there are frequent requests for short-time propositions that some needy student by making a little sacrifice could benefit from, and occasionally there is a position open that would require only a few hours of a student's time each day. In order to profit by these opportun-

(*Continued on page 100*)

### THE BIOGRAPHY OF A. L. EUSTICE, '07 AS QUOTED FROM *The Story of Electricity*

The story of the growth of the Economy Fuse & Manufacturing Company is a record of the achievement of a young man with imagination and unwavering courage; of the execution of his convictions, and of his belief that an article which best and most economically served the public need, however much opposed, would, in spite of overwhelming opposition, ultimately enjoy a great demand, and go into general use in

A. L. Eustice

illimitable quantities. It is also a record of remarkable progress in the application of sound ideals to an intensive utilization of men, methods, machinery, materials, money and commonsense—associated with an unprecedented program of patent battles, national advertising and advanced sales methods.

The business and the plant of the Economy Fuse & Manufacturing Company are a monument to the ability, vision, and determination of the President of the Company, Mr. A. L. Eustice, whose unceasing efforts and skill in turning defeat into victory have built up a huge annual business from nothing in the short space of only fifteen years.

The Economy Fuse & Manufacturing Company, as pioneers in the manufacture and marketing of cartridge enclosed fuses of the renewable type, has accumulated vast resources of information, pertaining to the design, construction, and operation of thermal fuses of all descriptions, and holds the key to the treasure chest of priceless experience, gathered in attacking and analyzing the problems of design, and performance in commercial use. Its proved-out-in-practice designs have become a guide and a stimulation to still greater efforts toward a further development in the art of thermal fuse design, with incalculable benefit to the art and the public in minimizing fire and accident hazard.

The Economy Fuse & Manufacturing Company was organized and incorporated in

(*Continued on page 100*)

### NEWS OF THE ARMOUR ALUMNI

B. G. Jamieson, '97, has been very busy lately on account of the added duties he has assumed as vice-president of the American Institute of Electrical Engineers in which position he has to keep his fingers on the members of his profession who are located in what is designated as the Great Lakes region. Mr. Jamieson, by the way, is recognized generally as an authority on central station engineering.

Ralph D. Fisher, '23, sent us a long night letter from Detroit the other day telling of his recent marriage. Further details are not forthcoming at this time but we have wired our correspondent at Detroit to follow it up. R. D. is a construction engineer with the General Electric Company and after office hours hustles home to 3320 Chicago Boulevard, Detroit.

C. O. Ransom, '99, writes on the stationery of Ransom and Company, 830 Vincent Ave., Cleveland, Ohio, but is too modest to tell us just what his connection with the firm is. Can anyone shed any light on this?

Eugene E. Johnson, '25, has left the Thomas Elevator Company and is now doing designing in the Chicago office of the Fairbanks-Morse Company.

William J. O'Connor, '20, and George D. Conner, '22, of the firm of Conner and O'Connor, won first and third honors respectively in the home competition conducted by the Chicago *Tribune* for the best design of a five room house which afforded the maximum of beauty, convenience and practicability.

Elizabeth Kimball Nedved, '25, was an exhibitor at the Chicago Artist's Exhibition at the Art Institute, which recently closed. The subject was *The Fish Market of Chartres.*

C. Arnold Grasse, '16, has been appointed manager of the improved risk department of the Home of New York, succeeding Frank J. McFadden, who died recently. Since 1921, Mr. Grassee has been Mr. McFadden's assistant with the title of supervisor.

Leonard Peterson, '16, who has been special agent of the improved risk department of the Home in Chicago, has been appointed assistant manager of the department at the home office, and will remove to New York shortly.

T. K. Pfafflin, '15, has been appointed manager of the improved risk department of the Home in Chicago, succeeding Leonard Peterson. For the past three years Mr. Pfafflin has been an inspector of the improved risk department with headquarters in Chicago.

Bumped into Edward W. Scheuer, '20, the other day on Michigan Boulevard. He is the same Ed we used to know back in the days when he was at Armour. He is now devoting his attention to the affairs of the Continental Fibre Company, manufacturers of phenolic products, with offices in the Wrigley Building.

(*Continued on page 100*)

## ALUMNI EMPLOYMENT BUREAU

(Continued from page 99)

ities, those students who desire part-time employment are urged to make formal application.

All applications for positions should be addressed to the Manager of Industrial Relations, stating therein their education, business training, present occupation and duties, salary received, salary desired and the kind of work wanted. Those in a position to employ men should specify the nature of the position to be filled and the qualifications any applicant must have, as well as the salary to be paid. Of course, it is understood that all applications and requests of either nature when referred to the bureau will be treated strictly confidentially.

## A. L. EUSTICE

(Continued from page 99)

1911, and was located in very small quarters at Pittsburgh, Pa. Its business was so small that it was not at first able to support even the one man organization. But after a few months, in the Spring of 1912, the original customers came back with many repeat orders of greater size, and contrary to all predictions it had been demonstrated that a reliable fuse of the renewable type not only could be made, but could find an increasing field of use.

In the Spring of 1912, a request was made the Underwriters' Laboratories to the Company, to submit its "Economy" Renewable Fuses to them for examination and test. The contents of the "two by four" plant were loaded into a car and shipped to Chicago, where electrical test facilities were readily obtainable, and after a suitable location was found, the business was re-established in modest quarters. Then the product was submitted to the Underwriters' Laboratories in May, 1912, for examination and test, with a view to obtaining approval, or the marking of the fuses as Standard and to secure the listing of the trade name of Economy Fuses in the list of Inspected Electrical Appliances.

The tests were completed and the report issued about July, 1912, and while they showed a thoroughly satisfactory performance, the Underwriters' Laboratories concluded that the rules of the National Electrical Code did not permit the marking of renewable fuses as Standard, and referred the question to the Switch and Cut-Out Committee of the Electrical Committee of the National Fire Protection Association for their consideration and advice. The findings of this Committee were not satisfactory to the Economy Company, as no definite action had been taken, and thus for some years the question was involved in many spirited protests and discussions in the various Committees and Associations.

As pioneers in the Renewable Fuse field, the problems encountered by the Company were most serious. The united opposition of manufacturers of the then standard non-renewable fuse, together with the unfavorable attitude of the National Fire Protection Association, and its various committees, forced the Economy Fuse & Manufacturing Company, in self-defense, for its "right to live," to resort to public hearings before the interested committees. Still no relief or satisfaction was obtained, and, at last, a restraining order of the courts prevented the Electrical Committee from doing any act which would be detrimental to the Economy Fuse & Manufacturing Company. Finally, at the invitation of the Underwriters' Laboratories, the Company was induced to submit the question of the relative fire hazard to the U. S. Bureau of Standards for arbitration, as a national unbiased arbitrator.

The Bureau of Standards, after months of investigation and hearings, reported its findings and recommended an extension of use in order to determine definitely the relative hazards of Economy Renewable Fuses as compared with other non-renewable fuses listed as Standard by the Underwriters' Laboratories. Actually a two-hundred page book was issued by the Bureau of Standards on the subject. (Technologic Papers, Bureau of Standards, No. 74, December 1, 1916.) Meanwhile, the Economy Company had secured written permission for the use of its product from various municipal and Underwriters' Inspection Departments, the future was bright, sales increased by leaps and bounds, and the plant was greatly enlarged several times. But, at the same time, the company was now confronted with a new form of opposition, when several patent infringement suits were entered against it by manufacturers of non-renewable fuses.

In the first decision of the Courts, an injunction was issued restraining the further manufacture and sale of Economy Renewable Fuses, as then manufactured, and it was this event which proved to be a forceful illustration that "Necessity is the Mother of Invention." Soon through sheer necessity a new form of fusible link was discovered, which proved up wonderfully in performance, and ranks as a high order of invention. A basic patent of fundamental nature was issued to Mr. Eustice in due time.

This invention, popularly and universally known as the "Drop-Out" link, reduced remarkably the quantity of fusible metal volatilized on blowing, because the greater part of the metal was not fused. A large section dropped out of the circuit in metallic form, establishing a plurality of arcs in series, thus reducing the internal operating pressure to such a degree that the old conventional so-called arc quenching and cooling filling material was no longer necessary; and hence the filling material was omitted. The fuse with the Drop-Out link was then generally referred to as the air-space type in comparison with some ten standard non-renewable constructions in which filling material was employed.

Once more the demand for the Drop-Out type of fuses intensified until a six-story building was required to house the business. The pioneer Economy Renewable Fuse was the only renewable fuse in real popular demand, and as a result, several manufacturers, in the early part of 1918, solicited and were granted manufacturing licenses under the Drop-Out link patents. Today *no fewer than eight producers* (the General Electric Company, Westinghouse Electric and Manufacturing Company and Colt's Patent Fire Arms Manufacturing Company, and others) are manufacturing and selling renewable fuses under the license and the methods of the Drop-Out patents.

It was this technical and commercial victory that proved the truth of what Mr. W. H. Merrill of the Underwriters' Laboratories said at the Bureau of Standards: "Nothing that is wrong eventually prevails in America." Immediately, the Fuse Section of the Associated Manufacturers of the Electrical Supplies prepared a Standard for Renewable Enclosed Fuses which was adopted by the Underwriters' Laboratories and published in July, 1919, under which Economy Renewable Fuses were approved in all capacities under the Label Service Plan of Inspection in the Fall of 1919. Another notable chapter of electrical progress had been written.

## NEWS OF THE ARMOUR ALUMNI

(Continued from page 99)

One of the best regulars at affairs of the Alumni Association this season is David A. Pareira, '18. He has shown a real, genuine interest in all affairs, particularly the luncheons, and has been appointed a member of the luncheon committee. He is with the Chicago Art Marble Company at 2883 Hillock Avenue.

A new face at the March luncheon was that of Freddy Hertwig. Hertwig has abandoned the high-topped shoes and flannel shirts, as well as his penchant for the bottom of caissons and other lowly spots in the foundations of buildings, for a white collar job. He is now associated with the Construction Supply Company with offices in the Straus Building. Freddy reports he is out to elect a new mayor, as well as make a lot of money through his new business connection.

The erstwhile chairman of class social committees, W. K. Lyon, '21, must feel that there is going to be a change of administration in the City Hall. Bill has forsaken his position there for one with the Portland Cement Association who are located in their own brand new building on the near north side at 33 West Grand Avenue.

R. F. Jensen, '11, stopped in the other day to leave with us a change of business address. He is now engaged in doing architectural promotion work for the Beaver Products Company, Inc. They are manufacturers of wall and roofing materials at 2246 West 49th Street, Chicago.

We received a letter last month from George M. Fritze, '17, written from Orrville, Ohio. He had been connected with the S-C Regulator Company, for three years, until recently when that company was absorbed by the Swartwout Company. The plant is in Orrville, Ohio, and Fritze can be reached at 802 West Oak Street in that city. We were very glad to hear from Mr. Fritze and thank him for his good wishes.

Gordon C. Wilson, '04, who until a very short time ago was with Fairbanks-Morse and Company, serving in an administrative position, advises us that he is now affiliated with the Utilities Power and Light Corporation, with general offices at 327 South LaSalle Street, Chicago.

Was invited to President Raymond's office to meet Tracy W. Simpson, '09, who had stopped off at the Institute for a visit on his trip here from the Pacific coast. He is vice-president of the Electrical Products Corporation at 253-259 Golden Gate Avenue, San Francisco.

In the short time we had together we talked over several of Simpson's contemporaries while here at the Institute. He tells us that Herbert Rose, '09, is now manager of the radio department of Holwasser, Inc., in San Diego, California. C. M. Lindsay, '09, is operating a bookstore in San Jose under the name of C. M. Lindsay & Co. H. C. Frisbie, '09, is a manufacturers' representative doing business from Los Angeles.

It was a pleasure to visit with Mr. Simpson and the Armour Alumnus hopes that all alumni will make it a point when in Chicago to visit the Institute and let us know something about themselves and what they know about other alumni with whom they come in contact.

# THE ARMOUR ENGINEER

Published Quarterly by the College of Engineering

## ARMOUR INSTITUE OF TECHNOLOGY

Vol. XVIII March, 1927 No. 3



STAFF

Wm. W. Gothard ..... *Editor*
James D. Green ..... *Business Manager*

W. J. Zenner ..... *Assistant Editor*
C. A. Gustafson ..... *Assistant Business Manager*
J. J. Doheny ..... *Articles Editor*
T. P. Camp ..... *College Notes Editor*
J. W. Kent ..... *Fraternities Editor*
H. Kohn ..... *Societies Editor*
F. D. Payne ..... *Athletics Editor*
C. W. Burcky ..... *Engineering News Editor*
J. W. Urban ..... *Art Editor*
H. B. Ritman ..... *Art Editor*
C. Long ..... *Humor*
L. A. Ohlinger ..... *Publicity*
F. C. Steinhaus ..... *Publicity*
M. T. Goetz ..... *Photography*
L. K. Sairs ..... *Circulation Manager*
W. A. Morgan, C. Vander Molen ..... *Editorial Assistants*

Professor C. E. Paul ..... *Advisory Editor*
Professor J. C. Pebbles ..... *Unofficial Observer Editor*
Mr. J. Warren McCaffrey ..... *Alumni Editor*


**Our Slogan:** ***Make The Armour Engineer the best technical college publication in the country***

*Love the art, poor as it may be, which thou hast learned, and be content with it; and pass through the rest of life like one who has intrusted to the gods with his whole soul all that he has, making thyself neither the tyrant nor the slave of any man.*

*Whatever any one does or says, I must be good; just as if the gold, or the emerald, or the purple were always saying this, whatever any one does or says, I must be emerald and keep my color.*

*From Marcus Aurelius Antoninus.*

THE flow of the life stream of the American civilization is in its reverse direction. That is, the trend of the population is from the rural to the urban districts. When such a condition prevails among any civilized people, progression gives way to retrogression and a degenerate state results.

At least, this is the essence of what those interested in eugenics would have us believe; and having warned us of the imminent dangers, propound various cure-all schemes including birth control.

It is evident that these guardians of our national welfare have overlooked the fundamental of self government, namely that it is impossible to change the inclination of a peoples by legislation, a necessary adjunct in the execution of their schemes.

Any change in public attitude has as a cause a change in surroundings and influences. In this age of mechanical things and ever increasing multiplicity of iksome statutes, it requires no prophetic judgment to see just what influences will cause the most effective changes in future conditions. In fact, it has been the evolution of things and their ready adoption in the densely populated centers which has caused the attraction for rural inhabitants.

It is natural for people to live in the country. Man is in an unnatural environment when he lives in the crowded cities. Given even approximately equal advantages in country and city, and the trend of population will be toward the wide open spaces.

The engineer is responsible for our mechanical age. It is he who has brought about changes in our lives which have made rural conditions more attractive. What with the present means of travel, communication, and improved living and working conditions, life in the country is being placed upon a basis such that the advantages of the city are combined with those of the country.

Another phase of the engineer's work has just begun. It remains for him to stem the tide of migration, and attract those who constitute the economic, political and moral backbone of our nation back to the normal country life.

A GREAT deal of the college graduate's confusion upon entering business life, and the necessity for general mental and social readjustment, has been attributed to his spending a period of four years, more or less, in an unnatural environment much given to contemplation of the influences which appear to make for success.

Exhibits in the form of popularly recognized successful men are placed before the undergraduate. The hope is that the student may become impregnated with the essentials of success. The desired result is a product which will enter the work-a-day world and assume positions of responsibility commensurate with his abilities, advantages and training.

The actual result is usually a product which condescends by virtue of temporarily embarrassing financial deficiencies, to favor industrial houses with his presence providing they will create situations worthy of his superior talents, and allow him to indicate the weaknesses of their systems.

It all resolves itself into a case of the tail wagging the dog. The tendency is for the student to assume the artificial and outward appearance of success without the qualities of it.

Especially in academic institutions, there is too much investigation into the nature of individual inferiority complexes and what not, and not enough search after that rare quality, common sense. There is too much thought given to the results or manifestations of success, and not enough given to sincerity of purpose and a desire to render some service no matter how humble it may be.

AND what of teaching? Ah, there you have the worst paid, and the best rewarded, of all the vocations. Dare not to enter it unless you love it. For the vast majority of men and women it has no promise of wealth or fame, but they, to whom it is dear for its own sake, are among the nobility of mankind.

I sing the praise of the unknown teacher. Great generals win campaigns, but it is the unknown soldier who wins the war.

Famous educators plan new systems of pedagogy, but it is the unknown teacher who delivers and guides the young. He lives in obscurity and contends with hardship. For him no trumpets blare, no chariots wait, no golden decorations are decreed. He keeps the watch along the borders of darkness and makes the attack on the trenches of ignorance and folly. Patient in his daily duty, he strives to conquer the evil powers which are the enemies of youth. He awakens sleeping spirits. He quickens the indolent, encourages the eager and steadies the unstable. He communicates his own joy in learning and shares with boys and girls the best treasures of his mind. He lights many candles which, in later years, will shine back to cheer him. This is his reward.

Knowledge may be gained from books; but the love of knowledge is transmitted only by personal contact. No one has deserved better of the republic than the unknown teacher. No one is more worthy to be enrolled in a democratic aristocracy, "king of himself and servant of mankind."

Henry Van Dyke.

# COLLEGE NOTES

*Scholastic Standings—Registration—News of Societies*

THE following statistics, compiled by the Office of the Dean, give the scholastic standings of the members of the Freshman, Sophomore, Junior and Senior Classes of the College of Engineering and Architecture who were in attendance during the first semester of the college year 1926-1927. In this computation the grades in Physical Training were omitted. A credit (Cr.) either for work at the Armour Institute of Technology, or for work elsewhere, was considered equivalent to a grade of "C".

The average of the entire college body, a total of 768 students, is 85.3%.

The averages of the various organizations are as follows:

| | |
|---|---|
| The Senior Class | 87.5% |
| The Junior Class | 86.5% |
| The Sophomore Class | 85.1% |
| The Freshman Class | 83.4% |

The student with the highest average in the Senior Class is Mr. Leo A. Ohlinger. His average is 95.4%.

The student with the highest average in the Junior Class is Mr. Leslie J. Anderson. His average is 96.5%.

The student with the highest average in the Sophomore Class is Mr. Joel M. Jacobson. His average is 96.8%.

The student with the highest average in the Freshman Class is Mr. Emil Blomme. His average is 94.7%.

| | |
|---|---|
| Mechanical Engineering Department | 86.0% |
| Electrical Engineering Department | 86.0% |
| Civil Engineering Department | 83.7% |
| Chemical Engineering Department | 86.7% |
| Fire Protection Engineering Dept | 85.6% |
| Architectural Department | 84.1% |

THE HONORARY FRATERNITIES

| | |
|---|---|
| Tau Beta Pi | 93.0% |
| Scarab | 86.7% |
| Eta Kappa Nu | 90.3% |
| Phi Lambda Upsilon | 91.5% |
| Salamander | 91.9% |
| Chi Epsilon | 91.1% |
| Pi Tau Sigma | 91.9% |
| Sphinx | 89.0% |

SOCIAL FRATERNITIES

| | |
|---|---|
| Phi Kappa Sigma | 85.2% |
| Delta Tau Delta | 84.4% |
| Theta Xi | 83.5% |
| Sigma Kappa Delta | 85.6% |
| Phi Pi Phi | 85.5% |
| Triangle | 87.6% |
| Sigma Alpha Mu | 86.0% |
| Rho Delta Rho | 85.8% |
| Beta Psi | 87.2% |
| Kappa Delta Tau | 87.5% |

CLUBS

| | |
|---|---|
| Athenian | 87.7% |

The average of all students belonging to the Phi Kappa Sigma, Delta Tau Delta, Theta Xi, Sigma Kappa Delta, Phi Pi Phi, Triangle and Beta Psi fraternities (fraternities that rent or own their own chapter houses) is 85.5%.

The average of all other students is 85.2%.

In the computation of averages the following numerical values were given to the letter grades:

| | |
|---|---|
| A=97.5 | D=67.5 |
| B=90.0 | E=50.0 |
| C=80.0 | Cr.=80.0 |

## AN APPRECIATION

I wish to express my deep appreciation of the messages of sympathy and the beautiful flowers sent by the students, fraternities, faculty, and employes of the Institute on the occasion of the funeral services of my mother. Such tributes of thoughtful remembrance are most comforting and serve greatly to alleviate the burden of one's sorrow.

HOWARD MONROE RAYMOND.

## ARMOUR RADIO ASSOCIATION

The first semester of this year offered little opportunity for the Armour Radio Association to hold regular meetings. Possibly its existence was made known to a few of the student body who left their shop work, drawing, and chemistry experiments when the fire department so kindly replaced the antenna to its lofty position. This assemblage might well be called the best attended open meeting of the association.

The activity of the members has been mainly centered in the Institute's amateur radio station *9NI* in Chapin Hall. Groups have gathered there daily to discuss matters of interest. The operators have maintained schedules with distant stations to handle messages, thus taking part in the work of the American Radio Relay League of which *9NI* is an official relay station. The relay work has been done on a wavelength of forty meters, and a five hundred watt phone transmitter has been operated on eighty-five meters.

Although very little night operating has been done, the station has communicated with stations in all parts of the country, in Mexico, Australia, and the Antigua Islands, besides being heard in England and other distant parts of the world. Perhaps many wonder what the attraction is to those who "pound brass" at the station. An example or two might help to answer the question.

The operator of a station in Indianapolis recently in communication with *9NI* told our chief operator, L. F. Pfeiler, that he was blind; the operator of station *NL-4X* in the Antigua Islands is a leper, cut off from the rest of the world. The operator at *9NI* brought a ray of happiness to those fellows and experienced a sincerely happy feeling in his own heart, such as is felt by any one who has accomplished a like mission.

Radio brings not only its technical problems to the engineer and operator, but it overflows with opportunities of making others happy and creating a feeling of friendship and brotherhood between the nations of the world.

AFTER serving for some time in the Educational Division of the Chicago Association of Commerce, our comptroller, Mr. George S. Allison, has been recently elected vice-chairman of that division for the year of 1927.

Attention is called to the Rhodes Scholarship election for 1927. Any student who has completed at least his Sophomore year in college is eligible to candidacy. The scholarship is to Oxford University. For further information, apply to the Office of the Dean.

In the January issue of the ARMOUR ENGINEER, on page sixty-four, under the heading of Fraternities, Mr. Frank Jerome Fisher was listed among the pledges of the Rho Delta Rho fraternity. This is an error. Mr. Fisher is in no way affiliated with this organization.

The vacancy left by Professor White, formerly of the gas engine laboratory, is being ably filled at present by Mr. Otto Kuehn. Mr. Kuehn was a member of the class of twenty-two and since leaving school has been connected with the Gabriel Snubber Company. While in school, he was active in athletics and won letters in both baseball and basketball.

An interesting article by Professor McCormack on chemical plants in Illinois and Indiana appeared in the January issue of *Chemical and Metallurgical Engineering*. The selection of Professor McCormack to write this article proves again that Armour Institute of Technology has the most up-to-date and well informed faculty of any institution in the middle west, if not in the country.

The new chemical society mentioned in the last issue has changed its name from the Chemists Club to the Flask and Beaker. The members meet twice a week for general discussion and at least once a month for a social evening. Further information about this new organization will be found elsewhere in this magazine.

Word comes from the President's office that Professor Campbell, head of the mathematics department, is on a leave of absence enforced by sickness. We are sorry to learn this, and hope that Dr. Campbell recovers his health sufficiently to permit his return at the beginning of next semester.

During the absence of Professor Campbell, Mr. Spencer is putting in full time in the mathematics department.

## REGISTRATION SECOND SEMESTER 1926-1927

| | Senior | Junior | Sophomore | Freshmen | Total |
|---|---|---|---|---|---|
| Mechanicals | 27 | 26 | 33 | 41 | 127 |
| Electricals | 39 | 39 | 49 | 59 | 186 |
| Civils | 22 | 26 | 33 | 41 | 122 |
| Chemicals | 16 | 14 | 19 | 23 | 72 |
| Fire Protection | 25 | 34 | 26 | 35 | 120 |
| Architects | 15 | 27 | 27 | 54 | 123 |
| Totals | 144 | 166 | 187 | 253 | 750 |

## AMERICAN INSTITUTE OF CHEMICAL ENGINEERS

A joint meeting with the other engineering societies was held on Thursday, March 3, the subject being *The Birth of the Kilowatt.* The change from the usual chemical topics was enjoyed by every one who attended and the chemicals were out in force. Another joint meeting, with the Fire Protection Engineering Society, will be held in May when Dr. W. D. Harkins, of the University of Chicago, will speak on *The Transmutation of the Elements.*

George Crapple has been rendering yoeman services by calling for our speakers in his sumptuous seven passenger gasoline-eater. Incidentally, he returns them again to their domiciles, safe and sound; if that isn't service we miss our guess. Always keep "A step ahead of our competitors" is our motto, and George has made it possible for us to live up to it. Oscar Pinsoff also donated gratis his taxi services one day in an emergency, for which the Gods of Valhalla will reward him.

At the last smoker held some time ago, a one act play entitled *The Jest of Hahalaba* was made known with the original New York cast for the benefit of the cash customers. Considerable talent was unearthed; J. J. Doheny playing the part of Lord Strangeways; Elliott Youngberg, the spirit of laughter, Hahalaba; and George Crapple *serving* admirably as Snaggs, the butler. None other than our famous Shakespearean actor, George Parkhurst, acted as master of ceremonies in the form of an alchemist.

Dr. Klein, of the Wilson Laboratories, will address the group soon on some aspect of glandular therapy. Two years ago he spoke at Armour and explained some very interesting facts and misstatements about insulin, thyroxin, and some of the other glandular secretions. Doubtless his second talk will bring out the latest developments about these remarkable chemical substances.

Dr. R. E. Wilson, Director of Research for the Standard Oil Company of Indiana, will lecture sometime during April on *Winter Lubrication,* particularly with respect to the new *Iso-Vis* lubricating oil developed within the last two years at their Whiting laboratories. Arrangements have been made to make this a joint meeting with the Mechanical Engineering Society, as lubrication is of much practical importance to the mechanical engineer.

Students of the other engineering societies who are interested in these talks are cordially invited to attend the meeting—keep an eye on the bulletin board for announcements.

## FIRE PROTECTION ENGINEERING SOCIETY

At the first meeting of the Armour Fire Protection Engineering Society for the year 1927, Mr. W. R. Townley gave an interesting account of the activities of the Underwriters' Salvage Company in salvaging goods damaged by fire. Mr. Townley is well known to all members of the society as a member of the scholarship committee and a man prominent in the insurance field.

On January 20, Mr. M. H. Michaels, Burglary Department, Underwriters' Laboratories, addressed the meeting of the society. His talk concerned the protection of banks and stores against hold-ups, a timely and enlightening subject.

Mr. C. H. Pierson of Underwriters' Laboratories, on February 17 spoke on the subject of conflagrations. His talk was of special interest to all fire protects and was well delivered.

## THE BOARD

The Board, a senior civil organization, developed for the purpose of promoting the practical and social end of the students routine has held some very interesting meetings during the past and present semester. These meetings were not only of an educational character but served as recreation and relief from the grind of continuous studying.

Those who number among the charter membership of this organization are:

J. D. Green
J. J. Koeper
C. W. Lang
E. E. Roberts
B. Z. Cailles

The Board, wishing to spread its work over the entire school, has the pleasure of announcing that the following men have been elected to honorary membership:

R. C. Peacock
V. J. Peterson
F. D. Payne
L. K. Sairs
C. Long

## ARMOUR TECH MUSICAL CLUBS

In accordance with the plans of the executive body of the Armour Tech Musical Clubs, two concerts have been given. The effects of the success have already been felt and there is reason to hope for even more wonderful results in the Home Concert.

The second of the methods is planned to stir up interest is the organization of a musical honorary fraternity at Armour, to be known as Pi Nu Epsilon. It is felt that Pi Nu Epsilon will serve as a stimulus in putting all of the Musical Clubs upon a competitive basis. It will foster and encourage the work of the under-classman who is interested in music and, at the same time beckon as the ultimate goal to be attained by work in the clubs.

The officers of the clubs feel that they have this year launched the four organizations upon a program entirely different from the activities of former years. Weekly or bi-monthly meetings of the officers and the faculty advisor have been held throughout the year. We feel that, with the support of the student body, the next year will be an even greater one in the annals of music at Armour.

## GLEE CLUB

The director of the Glee Club, Dr. Protheroe, directed one of the largest choruses ever gathered together. This chorus of 2500 voices gave a concert at the Sesqui-Centennial Exposition held in Philadelphia. Concerning it, the following clipping from a newspaper serves to give some idea of the magnitude of the work.

"In looking on this great choir, the question rose unbidden in the minds of many musicians in the audience, 'Can any conductor effectively handle so great a throng?'; but with the first phrase of the opening number, the 'Clang, Clang' of the *Viking Song,* the question was answered. A tonal torrent burst with stupendous force upon the expectant crowd, but a torrent so shaped and held within bounds by the great conductor, Dr. Protheroe, that every haunting ghost of doubt was laid. Knowing that he played upon an instrument of seemingly limitless resources, completely obedient to his baton, the conductor worked his will with it in a manner little short of miraculous. Amazement was expressed at the flexibility of the vast choir and the great range of effects achieved by it."

We are certainly fortunate in having the services of such a director for the Glee Club and all men who possibly can should avail themselves of the opportunity of singing under Dr. Protheroe. The concert of March clearly showed that the Glee Club is capable of preparing a variety of numbers and in the future it is hoped that a series of entertainments may be given in conjunction with the other organizations outside of school.

## ORCHESTRA

There is an idea at school that the orchestra and the other musical club organizations are dependent on conscript labor. That is to say, that by holding forth a gym credit as bait, they manage to lure enough men into the organization to keep it running. This idea is entirely false and misleading. It is true that a gym credit is offered in the freshmen and Sophomore years, but this is only fair in return for the number of hours spent in practice and concert work.

The school forgets that there are large numbers of upper-classmen who work in the musical clubs purely from enjoyment of ensemble playing and with no thought of reward. A true musician enjoys playing in an organization in which each man's talent is combined and blended by the director to render the composition.

## STRESS AND STRAINS

The Stress and Strains has become an established institution at Armour, and has won for itself a permanent place in student activities. In spite of the fact that the Stress and Strains is one of the most popular of the musical organizations at Armour, the difficulties encountered in trying to maintain it are manifold. The schedules of the different men are so full and their time is so taken up with extra curricula activities that finding a time to rehearse resolves itself into a matter of taking turns at cutting other activities. However, the pleasure derived outweighs the difficulties.

The next concert to be given will be the Home Concert and will be the last for this school year.

## FLASK AND BEAKER

We are glad to announce at this time that the new chemistry club organized last semester has been named *Flask and Beaker,* and will henceforth be known by that name.

The objects of the new club, as stated in the constitution, are of a social and professional character and in fulfilling these requirements, the members become united in a manner that had previously been impossible. Permanent friendships of lasting value arise and closer contact with notables in the professional field of chemistry are assured.

Informal meetings are now held at least once each week, with smokers and parties of a similar nature held at not too distant intervals. On several occasions the members as a group attended the meetings of the Chicago section of the American Chemical Society. The consensus of opinion was that the evenings were well spent.

At a get-together smoker held during February, a play entitled *The Beggar and the King* was presented for the amusement of those who attended. The nutritious element that all engineers crave, namely, food, was also present to top off the evening.

At present the membership is composed almost entirely of seniors, but this semester the membership will be enlarged to include members of the other chemical classes at the Institute.

# FRATERNITIES

*The Armour Spirit is Nurtured by Her Fraternities*

## ETA KAPPA NU

Eta Kappa Nu is now taking on power for the present semester. The members are starting the wheels of the machinery for the events of the semester program, slowly but firmly in motion. Among the more prominent events of the future, besides the second semester pledging, will be the inter-honorary dance, theater parties, smokers, an essay contest, and—and—well, why tell everything?

Eta Kappa Nu reports that all of its members got along nicely last semester, and many of them are now on the last lap. They wish the members of the other fraternities and societies the same good fortune.

## SALAMANDER

Salamander is again in the midst of a very promising year, one that will long be remembered by its members. We are always striving for a closer fellowship, a fellowship among men of like interests. To aid this desire for a truer friendship and also to broaden our knowledge of Fire Protection, regular meetings are held at which current topics relating to our work are discussed. In the near future we hope to include our alumni in these discussions through means of correspondence or possibly a publication of articles by the active chapter. Undoubtedly we could profit by the varied experiences of our alumni who are distributed in the various fields of insurance.

## PI TAU SIGMA

To the regret of all the members, Brother Karl Figenbaum was forced to resign from the presidency of the honorary fraternity, Pi Tau Sigma. He was unwilling to retain the office because of outside interests which handicapped him in devoting time to the office.

The vice president was unanimously chosen as president. Brother Segler was then chosen to occupy the vacant chair.

Within the past month or two, we have done little socially, because of undeniable effort to make the grade at the end of the semester. We invite all the lower classmen of the mechanical engineering department to make a similar effort throughout the year, so that many may be found eligible for membership in Pi Tau Sigma.

## PI NU EPSILON

Pi Nu Epsilon was founded during the month of January, 1927, by a few members of the musical clubs, together with the kind help and co-operation of the Executive Council.

The aim of this fraternity is to foster music to a higher degree at Armour. Pi Nu Epsilon affords a goal that can be reached only by members of the musical clubs. Eligibility is restricted to juniors and seniors who have served faithfully at least two years in one of the musical clubs at Armour and who have done distinctive work in the clubs. Pledging is carried on in the fall and spring.

## TAU BETA PI

The thirteen new members of Illinois Beta of Tau Beta Pi are now participating in the many chapter activities, and are rapidly adjusting themselves to their new surroundings.

At a meeting held during the first part of the semester, officers for the remainder of the year were elected, with the following results:

*President*.....M. T. Goetz
*Vice-President*.....E. C. Youngberg
*Corresponding Secretary*.....C. W. Burcky
*Recording Secretary*.....C. H. Seeley
*Treasurer*.....R. S. Walsh
*Publication Representative*.....K. Parker

Brother Goetz, in his speech of acceptance, promised a semester full of action, and expressed the hope that every active would exert himself to repeat, or even surpass, the successful period that the chapter went through last semester under the leadership of Brother Burcky.

Walsh Usler
Goetz, Urban, Burcky, Seeley, Figenbaum.

The chapter enjoyed a theater party held during the week between semesters. The relaxation that such a party afforded was welcomed by all, particularly as it came immediately after the final examinations.

At a recent assembly, a standard engineering handbook was presented to the freshman with the highest scholastic average of last year.

Brother Green is Beta's representative on the inter-honorary dance committee. Plans are now under way for holding this annual event during the latter part of April.

## PHI LAMBDA UPSILON

Second semester activities are already under way for Omicron Chapter of Phi Lambda Upsilon, honorary chemical society. With ten active members in school this semester, good times are inevitable.

Brother Lehman is back with us this semester and it seems like old times again. He has been working in the laboratories of the Brunswick Company at Muskegon.

Phi Lambda Upsilon staged a one act play at the last chemical smoker, held at the Phi Pi Phi house, Brothers Parkhurst, Doheny, Youngberg, and Crapple furnished the action, while Brothers Lovejoy and Seeley acted as makeup men, property managers, technical directors, and explosive engineers. The play was a success from every standpoint. Contracts were immediately presented calling for other presentations and it is now rumored that the legitimate stage beckons them.

Another event which is always anticipated with pleasure is the inter-honorary fraternity dance. Phi Lambda Upsilon members are planning to turn out in force. Brother Urban is our representative on the dance committee.

Omicron chapter will present a suitable award to the highest freshman of the last year in the chemical course, following the worthy custom of recognizing scholastic effort. The presentation will take place sometime in the future, probably at the spring banquet of the Armour Tech branch of the American Institute of Chemical Engineers.

## THETA XI

With the burdens and worries caused by exams thrown from our shoulders and with a clean slate to begin the new semester, we feel that we have won the right to let our minds wander to thoughts more pleasant and of a lighter vein. In spite of the fact that Winter is still blustering around the boulevards with his snows and windy cold days, we can't help seeing that Spring is peeping around the corner at him and waiting for her turn. Accordingly our reflections follow the channels suggested by the two perfect spring days we had during February. We begin to plan spring dances, picnics, athletic contests, trips to the woods, and all other delights that only spring can bring us.

Influenced to quite an extent by the season and also somewhat by tradition, our social program for the spring of 1927 is unusually full. Several dances are planned. Parenthetically we might mention that regardless of their degree of excellence, they will be short of reaching the high mark of fun and good times set by the last dance, a hard times party given Saturday, February 19. The costumes ranged from engineers' garbs to full dress among the men. From first to last the dance was a riot of color, laughter, and fun. A Parents' Day and Faculty Smoker are among the other events.

On January 10, five neophytes started on their way over the rocky path of initiation which was finally to lead to brotherhood in Theta Xi. We are proud to announce the initiation of the following men:

E. A. Blume
J. B. Fee
Alan Tully
Hubert Van Dongen
J. T. Wolfe

## PHI KAPPA SIGMA

During the first two months of the new year, Alpha Epsilon of Phi Kappa Sigma found not a few things to keep her busy. On the week end before the final examinations a "Haunted House" dance was held at the fraternity house. Owing to the fact that very little had been done in the way of social activities since last fall, the entire active chapter and pledges were highly enthusiastic over this dance and thus it was made a complete success.

The following week end, thoughts were turned toward more serious subjects and we faced the final examinations. These over, everyone was ready for the few days rest which followed.

The first week of the second semester was

one that will long be remembered by the new members of the fraternity; their probation week. Though the time seemed a year to them, the week finally passed and on Saturday evening, the following men were initiated into the brotherhood of Pi Kappa Sigma:

W. H. Barry
E. P. Boynton
E. S. Geiger
M. H. Graening
A. J. Reeo
H. V. Richards
Walter Scott, Jr.
D. W. Smith

It is with great pride that we announce these new members and we hope that it will be with the same pride that they display the badge of membership to this fraternity.

## DELTA TAU DELTA

Now that the half way mark has been reached, we are looking forward to the new semester with anticipation. However, it is hard to forget some of the things which have recently transpired. The quarantine to which we were subjected for three days promised to be quite amusing, but by the end of the first day we had had enough.

The chapter is glad to welcome back Mansell Davis who is returning to school after an absence of eight months.

We are eagerly awaiting the annual Delt Prom which will be held at the Blackstone. Ollie Castle is representing Gamma Beta on the committee and, from his reports, this affair promises to be one of the outstanding events of the 1927 social calendar.

The Western Division Conference of Delta Tau Delta will be held in Champaign during March. Several members of the Chapter expect to attend.

## SIGMA KAPPA DELTA

Now that the finals are over, we are trying our best to enjoy life again. We are assisted along our merry path by the realization that spring is upon us—may it come on Sunday so we may all enjoy it.

We had the usual large representation at the sophomore informal and we heartily congratulate the Sophs for the manner in which the affair was handled. It was a mighty fine dance.

The first weeks of the new semester were spent in getting our pledges into shape for initiation. An alumni smoker was held on February 18. The following day, Saturday, February 19, was "Decoration Day." A good time was had by all, with the possible exception of the initiates although they were more than eager to turn in their pledge pins and become full fledged members.

On the evening of Saturday, February 19, the initiation banquet was held at the Electric Club. Here the active chapter and an especially large representation of the alumni welcomed the following men into the fraternity:

W. A. Anderson
C. A. Blomquist
D. R. Bray
G. B. Cornwell
P. S. Deiwert
C. E. Siebert

We are also glad to announce that Professors Libby and Moreton have become members.

## PHI PI PHI

We are well along in the second semester, but we cannot refrain from relating experiences of the last days of last semester. During the week between semesters everyone appeared at the house to assist in a general clean-up in preparation for a dance, which was held on February 5. This function was unique inasmuch as it was a bi-chapter dance given in conjunction with Alpha Chapter of Northwestern University. The growing spirit of good will and co-operation which has hitherto manifested itself since the consolidation is again evidenced in this occasion. The decorations bespoke the new spirit. The purple and white prevailing in one part of the house, the yellow and black in another bound by the turquoise blue and black of the fraternity. The memories of this occasion will be among the most cherished of events at Gamma's house.

With the coming of the new semester, we would feel as though we had neglected someone as well as missed something ourselves, had we not held a Dad's Banquet. The comments which are still pouring in are indicative of the success of the occasion.

Perhaps you have noticed the air of relief and easy nonchalance in the bearing of our freshmen. They have cause to be at ease; initiation has come and gone. They have put aside the black and gold pledge button for the badge and we are proud to introduce them to you.

J. A. Bechtold
C. L. Carlson
J. A. Rohrer
C. L. Rosenquist
R. A. Shoan
E. W. Short
R. F. Stellar
F. O. Tell
C. Winkler

## TRIANGLE

February 19 was a big day for eight men at Armour Chapter. This was the day of initiation, hence we wish to introduce the following men as brothers in the Fraternity:

J. B. Garth
W. L. Hafner
F. A. Schoneman
R. M. Spencer
M. G. Whitfield
R. H. Windbigler
T. A. Woods

Three days before, Triangle had a smoker for the faculty. A feature for the evening was a short skit by the pledges. If anyone does not think that Bob Johnson makes a nice daughter, he is slightly in error. And then, too, Jack Garth, in the role of a husky father shows great promise as an actor. Maybe he wont be an engineer after all.

Prior to all this, a dance was given by the Chicago Association of Triangle at Columbus Park. The active chapter was well represented and, needless to say, every one had a good time.

The future promises us two events of real interest, a theatre party to be held in March and a dance at some later date.

## RHO DELTA RHO

The new school semester finds all the boys back with very few failures caused by the late examinations. The fellows are working hard to live up to their New Year's resolution—to bring us out of the scholastic slump into which we fell at the recent ratings.

Rho Delta Rho takes pleasure in announcing that the following men, having lived through the inquisition held at a recent date, have been accepted as brethren by the fraternity:

B. Bernstein
E. Michealson

On Sunday afternoon, February 5, we enjoyed a get-together with some of our alumni at the home of Manny Skolnick. In the evening a score of us went to Temple Center in Albany Park, to hear Mr. Amsbary speak on *Humor*. Needless to say, this was a fitting climax for a pleasant day.

## BETA PSI

Beta Chapter of Beta Psi Fraternity wishes to announce the initiation of the following men into the brotherhood:

A. C. Haegele
R. E. Johnson
T. Johnson
N. B. Lind
J. W. Manz
O. C. Marek
A. T. Reglein
A. L. Scully
R. Swanson
R. VanOsdol

On Friday evening, February 18, the chapter held a house party. The faculty members as well as the pledges and actives were one hundred per cent in attendance. Dancing and card playing were the chief amusements of the evening.

Now that we are more settled in our new home, we are endeavoring to broaden the scope of our social activities.

## SIGMA ALPHA MU

Sigma Alpha Mu is enjoying a healthy midseason. The semester just ended was one of hard work and plenty of wholesome enjoyable fun.

We are indeed happy to welcome Sid Russakoo, of Xi chapter, to Armour. His *fraters* certainly feel that his association with Armour is a stroke of good fortune for Sigma Epsilon.

May we also express our pleasure in having Charley Polacek back with us. We certainly lost a lot when Charley left, a year ago, and now can only feel his greater worth.

In conclusion, we wish to record the very encouraging outlook presented by our pledges. We are happy at their extraordinary efforts to acquire the Sigma Alpha Mu spirit and know that their zeal will not be unrewarded.

The future for us is one of optimism. We hope it is so for all.

## KAPPA DELTA TAU

Both scholastically and socially Kappa Delta Tau is now entering upon what is probably the most successful term of its career. Since every member makes it his duty to attend all affairs and meetings, the events are all successful.

At a dinner given at Rainbo Gardens on Saturday, January 29, there was a perfect attendance, which exceeded the expectations of the arrangement committee.

At the time of this writing, six pledges are looking forward with apprehension to their initiation with its attendant ceremonies on March 5. A 100 per cent attendance has been arranged for so that the members at least can be assured of a good time.

# ATHLETICS

*Baseball and Golf Schedules Published*

## HONORARY FRATERNITY TO BE FORMED

A new national honorary fraternity is to be formed at Armour this spring. It is Sigma Delta Psi with chapters in quite a few of the colleges and universities about the country. In order to qualify for membership three men at least must pass the tests as set forth in a small booklet now in possession of the Honor A society. These include about ten events such as running, jumping, swimming, tumbling, and a few other sports. Details will soon be published and candidates will make their try-outs. It is expected that several men will be eligible for membership by the end of the present semester.

## BOXING AND WRESTLING

An interclass boxing meet was held at the gym on January 13 and 20. Several matches were run off each day. Had some outsider witnessed the affairs, he surely would have thought we were the butchers indeed. Nearly every one of the matches was hard fought from start to finish. In most cases the contestants went three rounds and in cases of a draw an extra round was added. It was pleasing to see so many freshmen out for the teams. One of the best battles of the day was furnished by Cohen and Payne. They had hardly stepped out of their corners when Payne was knocked clear off his feet to the floor. However, he arose and then the battle was on. One would think the two were mortal enemies instead of friends, the way they fought the rest of the fight. The bout was declared a draw and never finished. The results follow:

W. Buehling (137, F) over J. Netedu (140, F) 4 rounds.

H. Eckelman (124, F) over S. Schwartz (130, F) 4 rounds.

R. Palmer (140, F) over G. Baker (140, F) 2 rounds.

R. Palmer (140, F) over H. Eckelman (124, F) 3 rounds.

W. Buehling (137, F) over R. Palmer (140, F) 3 rounds.

W. Healy (135, So.) draw B. Bernstein (135, So.) 3 rounds.

F. D. Payne (157, J) draw S. Cohen (173, J) 3 rounds.

F. Wolosewicz (156, Sr.) over M. Spiegel (153, So.) 3 rounds.

On February 24 the Y. M. C. A. College met our wrestling team at Armour. Eisenberg gave Armour their only points by obtaining a fall over Stater of Y in the record time of twenty-five seconds. This is quite remarkable in view of the fact that he has been playing basketball and not practicing with the wrestling team. Y won the meet with three falls and three decisions and Armour had to be content with one fall. The results of the meet were as follows:

Murren (128,Y) Tecker (127, A)
Murren won by a fall in 6:09
Kelly (156, Y) Miller (156, A)
Kelly won a time decision of 5:12
Slater (148, Y) Eisenberg (151, A)
Eisenberg won by a fall in :25
Unbles (135, Y) Nissly (135, A)
Unbles won by a fall in 4:00
Peach (161, Y) Swinson (168, A)
Peach won by a fall in 5:22
Mingus (148, Y) Green (158, A)
Mingus won an overtime decision of 5:10
Buch (178, Y) Weisberg (190, A)
Buch won a time decision of 7:10

## OUR VARSITY CAPTAINS

### BASKETBALL

**Austin Augustine**

Basketball is known as the king of winter sports, but it does not derive its name from the players because it takes a real man to master its hard and tedious technique. The team started practice about the first of December and plays through until the first of March. The leader of this squad of iron men is Augie who is now playing in his

Austin Augustine, '27.

third year with the team. It is natural that Augie should report out for at least one college sport, since he played football, baseball, and basketball while attending Pullman Tech during his high school period. In his freshman year at Armour he played on the basketball team of his class, which won the school championship. In so doing they won their first sweaters. It is interesting to note that since that time, all the men on that team have won at least one letter at Armour. In the spring he repeated on the class baseball team and was one of twelve to receive medals for this honor. Since that time he has devoted his time to the team of which he is now captain, playing as running guard. Augie is now taking the fire protection course in engineering although he started out as an electrical. He is a junior and twenty-two years of age. It is quite a sight to see Augie and Scud Kuffel take the ball and tear down the floor with it to sink a basket. Augie expects to be back next year to help instill some of the Armour fighting spirit into the team.

## BASEBALL

Coach Bill Krafft called out his pitchers and catchers for their first spring workout on February 8. Some fifteen men reported for practice and a lot more reported that they would be out for the other positions when the regular season opened. Several of last year's team graduated so that there are several positions open. Now is the time, Frosh, to try out for a team. Captain Helgren did not return to school this year; of the letter men, Alexander, Hofer, Eisenberg, Jennings, Kuffel, Rosetti and Edstrand are back. Last year the team won seven and lost seven games but it is expected that a better record will be hung up this year.

## GOLF

Coach Leigh is priming his charges for another successful season this spring and, with five veterans swinging the sticks again in the form of Captain Urban, Wes Miller, Harry Bates, Vic Peterson, and Christianson, his anticipations will probably not be in vain. Some excellent reserve material is also available in Quinby and Cummings. It's a funny thing about golf—such a bunch of old-timers back in the plus sixes again, and all of them *green* material.

The boys aren't saying much but they are spending considerable time each day in practice, straightening out the drives, putting backspin on the pellet, and directing the globule to its proper resting place in the lower depths of the bucket. Even during the winter and early spring practice, rounds were held in some of the indoor golf schools; daily practice in the nets with occasional sessions out of doors is the present program.

Twelve matches have been scheduled, calling for two out of town trips. Contracts have already been signed for home-and-home matches with three tough opponents—Notre Dame, Wabash College, and Marquette University of Milwaukee, so that the engineers are in for plenty of competition. The Marquette team boasts several stars, including a former Wisconsin intercollegiate champion, Wabash has two former Indiana state junior champions, while Notre Dame, from preseason dope and a knowledge of the strength of its teams in former years, also appears to have a strong team. Victories over these teams will require plenty of pars and birdies.

The strengths of the Crane College, Carroll, Loyola, and Lake Forest teams, with which games are assured, are more or less unknown quantities. The home matches will be played at the Evergreen Country Club, Ninety-first street and Western Avenue.

The first match is at Evergreen with Crane on Saturday, April 3. The remainder of the schedule, some of the dates of which are tentative, follows:

April 27, Loyola at Evergreen.
April 30, Lake Forest at Lake Forest.
May 3, Notre Dame at Evergreen.
May 7, Loyola at Big Oaks.
May 12, Carroll at Waukesha, Wis.
May 13, Marquette at Milwaukee.
May 17, Crane at Edgebrook.
May 21, Wabash at Crawfordsville.
May 25, Carroll at Evergreen.
May 28, Marquette at Evergreen.
June 1, Lake Forest at Evergreen.

## ILLINOIS RELAYS

On February 26 part of the track team attended the Illinois Relay Carnival at the University of Illinois. In the 2 mile college section only two teams decided to run of the ten entered. These were Knox and Armour. The Haskell Indians who won the same race in the university section were entered with us but were ruled ineligible to compete. Captain Payne started the race and finished some fifteen yards behind his man. He gave the baton to Samuelson who lost about the same distance and Long started out to recover the lost ground. He set too fast a pace and tied up so that he became sick and

(*Continued on page 110*)

# ENGINEERING NEWS

## THE WORLD'S GREATEST TURBO-GENERATOR SETS

### Design Features Notable Increase in Unit Capacity

The General Electric Company has now under process of construction turbo-generator sets of record capacities, while units already installed and already in operation, are larger than any hitherto fore built.

The machines built for use in the Richmond Station of the Philadelphia Electric Company are of 60,000-kw. capacity and are now in successful commercial operation. The turbines are of the tandem-compound type, with double flow at the low-pressure end, and operate at 1800 r.p.m. The steam conditions are 375 pounds at the throttle with a temperature of 675 degrees F.

Present day electrical engineering requires considerable foresight in central station design, as is evidenced by the fact that work is now well under way for the installation of a 91,500-kw. unit in 1927, a 94,000-kw. unit, in 1928, and a 208,000-kw. unit in 1929.

The 208,000-kw. set will be installed in the State Line Station of the State Line Generating Company near Hammond, Indiana. The set is composed of three units in tandem, operating at 1800 r.p.m. 600 lb. steam pressure is employed. A feature of this design is the first application of steam reheat, for the steam, in passing from high-pressure to the two low-pressure cylinders, will be reheated to 500 degrees F., with steam at boiler pressure and temperature.

The high-pressure turbine will drive a 76,000-kw. 0.85 power-factor main generator, while each low-pressure turbine will operate a 62,000-kw. main generator and a 4000-kw. service generator. The main generators are all wound for 18,000 volts. The condensers for these turbines will require 400,000 cubic feet of cooling water per minute.

A 77,000-kw. cross-compound turbine-generator set built for the Crawford Avenue Station of the Commonwealth Edison Company of Chicago is now in successful operation and a 90,000-kw. unit of the same general design for this station is now under construction.

Other large sets completed include a 60,000-kw. single-cylinder 25-cycle turbine-generator for the Buffalo General Electric Company and two similar sets for the East River Station of the New York Edison Company. The illustration on the cover shows one of these 60,000-kw. sets.

The new East River Station is located on the lower end of Manhattan Island; ultimately it will have a capacity of 1,000,000 kilowatts. Each unit is approximately 17 feet high, 65 feet in length, with a net weight of 1,312,000 pounds. Each hour it is in operation it will require the energy of thirty tons of coal—a thousand pounds a minute—which it will convert into eighty thousand horsepower of electrical energy to be used for the light and power needs of New York. Altogether there will be nine units, the smallest having a capacity of 60,000-kw. giving the station twice the capacity of any in Europe and producing more electric power than the projected development of Muscle Shoals.

John Liston, of the General Electric Company, in describing the units, says:

"These machines are not only the largest turbine-generators at this speed that have been built, but they have incorporated in them the developments in generator design and construction which have resulted from research and tests for the past two or three years and which have combined to make them the most efficient turbine-generators in operation.

"Some of these features are multiple-flow radial ventilation with air-slide wedges, non-magnetic armature ends, transposed-coil bar windings, grooved and ventilated revolving fields, and aluminum saddles and wedges."

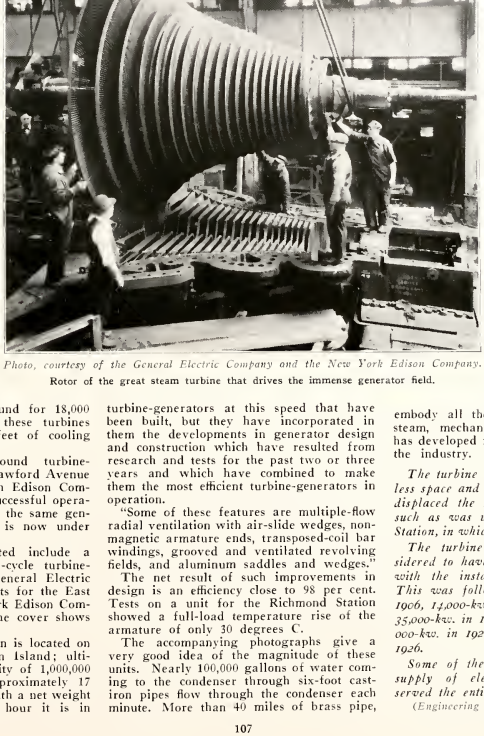
The net result of such improvements in design is an efficiency close to 98 per cent. Tests on a unit for the Richmond Station showed a full-load temperature rise of the armature of only 30 degrees C.

The accompanying photographs give a very good idea of the magnitude of these units. Nearly 100,000 gallons of water coming to the condenser through six-foot cast-iron pipes flow through the condenser each minute. More than 40 miles of brass pipe, with a total surface of over one acre, condense the exhaust steam from one of the huge turbines. The size and weight of the machines are such that they were shipped in parts to the new station and assembled there into the complete unit. Single parts, such as the upper part of the turbine exhaust hood, weigh as much as two hundred tons, this latter being the largest casting ever made at the Schenectady works of the General Electric Company.

Both units for the New York Edison Company were assembled and tested, preliminary to shipment to New York, in building No. 60, the largest machine shop in the world. Our own Professor Nash, of the electrical department, has done considerable work in this building several years ago, supervising the testing of the machines under construction at that time.

The accuracy of workmanship on these units is an interesting feature in connection with the machining of the parts. One unit was removed from the test blocks and assembled parts for the second were placed on the same blocks without adjusting them, and the alignment of the second unit varied only 0.006 inches at all surfaces in its entire length of 65 feet.

The installation of the new Chicago-district equipment, such as the 90,000-kw. unit for the Crawford Avenue Station, and the State Line Station with a three-unit set of 208,000-kw. capacity, operating in tandem, will be followed with interest by electrical engineers of the Chicago district, for these units, like the others mentioned above, embody all the new features that diligent steam, mechanical, and electrical research has developed for the future requirements of the industry.



*Photo, courtesy of the General Electric Company and the New York Edison Company.*

Rotor of the great steam turbine that drives the immense generator field.

*The turbine type of generator unit, taking less space and consuming less steam, quickly displaced the reciprocating type of engine, such as was used in the old Pearl Street Station, in which Mr. Edison worked.*

*The turbine industry is generally considered to have started in Chicago in 1903, with the installation of a 5000-kw. unit. This was followed by one of 8000-kw. in 1906, 14,000-kw. in 1908, 20,000-kw. in 1911, 35,000-kw. in 1913, 45,000-kw. in 1917, 60,000-kw. in 1924, and 77,000-kw. capacity in 1926.*

*Some of these machines will generate a supply of electricity which would have served the entire city of New York in 1906.*

(Engineering News continued on page 110)

# HUMOR

## *A Hearty Laugh Doeth Good Like a Medicine*

### Sudden Timber

Sweet Young Thing: "Are you quite sure these seeds will grow into big strong trees?"

Shopkeeper: "Madam, I will guarantee them."

Sweet Young Thing: "Well, in that case I'll take a hammock as well."

—*Service.*

### "H" for "Helpful"

The class in surveying had been divided into 4-man parties for practice in surveying around obstacles. "H" was clearly still indisposed after a big night.

H: "Well, fellows, I want to do my share, but you see how I'm fixed."

Party Leader: "Well, you just crawl under a bush and rest, we'll get along somehow."

H: "No, I want to help. I'll tell you, I'll be the obstacle."

—*American Forests and Forest Life.*

### Versatile

Itinerant Gardner (with large shears): "Morning, mum—trim your grass, mum?"

"No, thank you."

"Clip your bushes, mum?"

"No."

"Bob your hair, mum?"

—*Boston Transcript.*

### Now You Tell One

A mule and a Ford are said to have met on the highway.

"And what might you be?" asked the mule.

"An automobile," answered the Ford, "and you?"

"I'm a horse," replied the mule.

And they both laughed.

—*Christian Evangelist.*
—*Yellow Jacket.*

Patient—Do you think you will undertake this operation?

Doctor—No, but I have a friend in that business. —*Cincinnati Cynic.*

Small Boy—Paw, do cats go to Heaven?

Dad—No, Son, a cat is an animal and animals have no soul, and anything that has no soul cannot enter the kingdom of Heaven.

Small Boy—Well, then, Paw, do little kittens go to Heaven?

Dad—(Wearily) No.!

Small Boy—But, Paw, what do the angels use for harp-strings?

### They Call 'em Chryslers Now

E. E.—"I see that they'll have to change the unit of magnetic flux."

C. E.—"How come?"

E. E.—"They aren't making Maxwells any more." —*Pennsylvania Triangle.*

Medicine Vender: "Two years ago I was a physical wreck. What do you think has made this great change?"

Bystander: "What change?"

—*Technic.*

### Putting on Airs

"He's got an arrogant air about him."

"I hate men who use perfume, don't you?"

Father: "Daughter, it is eleven o'clock."

Daughter: "Yes, I know, father, but William's watch isn't going."

Father: "Well, how about William?"

It is difficult to believe heredity after your only child has made an ass of himself.

"Please reconsider, Helen. If you don't I swear I'll blow my brains out!"

"Oh, that would be a good joke on Dad. He thinks you haven't any."

He—He reminds me of Paderewski.

She—But Paderewski isn't a violinist.

He—Neither is this chap!"

Billie—Pa sent me for a piece of rope like this.

Oilshop Dealer—How much does he want?

Billie—Just enough to reach from the goat to the fence.

Libby: Tom's new mustache makes me laugh.

Marion: Yes, it tickles me, too.

*Minnesota Techno-Log.*

Protrude (playing saxophone): They tell me you love music?

Intrude: Yes, but never mind; keep on playing. —*The Sydney Bulletin.*

Soph—What would a cannibal be who ate his mother's sister?

Frosh—I'll bite on that; what?

Soph—An aunt-eater, of course.

—*Princeton Tiger.*

Cactus Bill—Air you the fresh young feller what sold me this stuff yesterday and said it was tooth paste?

Clerk—Yes, sir.

Cactus Bill—Well, I tried fer half an hour this morning, and I'll be derned if it would make my teeth stick in.

—*Stanford Chaparral.*

"What kind of a town is this, anyway?"

"College town."

"And what do the people who don't go to college do?"

"They do the people who do go to college."

—*Purple Cow.*

Fingerman: "My girl said this poem of mine caused her heart to miss a beat."

Editor: "Rejected. We don't want anything that will interfere with our circulation."

"I want some winter underwear."

"How long?"

"How long? I don't want to rent them; I want to buy 'em." —*Iowa Frivol.*

### Sayings of Toonerville Folks

"I hear the old bridge outside town has collapsed."

"I can't understand why: we just gave it three coats of paint and it looked like new."

"Egotism is the anaesthetic nature gives to deaden the pain of being a fool."

### Definition of a Man

A man is something that can see a pretty ankle four blocks away while driving his car in heavy traffic, but when in the open country will fail to note the approach of a locomotive the size of a barn accompanied by a flock of thirty box cars. —*Rose.*

A freshman received a paper with the following upon it: "D— poor paper!"

He took it back and asked, "Please, professor, what is the mark?"

Prof. (in a Mechanics Lecture): How would you tell the height of a tower by means of a barometer?

Engineer: I would lower the barometer from the top of the tower, then I would measure the rope.

### Safety First

A traveling salesman, driving over a strange road in West Baden, Indiana, late at night recently, halted his car suddenly at a road sign, saying, "Stop." The just in front of him there moved across the road a family party of skunks, including father, mother and three children. Now the salesman wonders if skunks can read.

—*Butte Daily post.*

Prof.: What is necessary to a nation to have a stable government?

Student (Just awakening from a siesta): Good horses.

—*Oregon Orange Owl.*

"And did the speaker electrify his audience?"

"Naw, gassed 'em."

Two colored gentlemen who had just reduced the population in a farmer's henroost were making a getaway.

"Law's, Mose," gasped Sam, "why you s'pose them flies follow us so close?"

"Keep galloping, nigger," said Mose. "Them ain't flies; them's buckshot."

—*Iowa Engineer.*

### Headlines

"SPARE TIME CALLED BREEDER OF CRIME" —*Evening Ledger.*

In that case, all engineers would be angels.

"What did your father die of?"

"Throat trouble."

"Oh, yes, I remember now. They hung him."

He—Where did you skate when you first learned?

She—Why, you horrid thing.

—*California Engineer.*

# "Long enough to reach the ground"

LINCOLN'S famous answer to the question "How long should a man's legs be?" suggests a similar answer to the question "How large should an industrial organization be?"

Large enough to do its job, of course, which simply means that there's need in this country of ours for both small and big businesses and both can prosper.

The job of providing electrical communication for the country calls for a vast organization backed by vast resources. And that's what the Bell System is.

Here great size has advantages in greater operating efficiency through which its customers benefit, and advantages to those engaged in the industry who find here a wide range of interesting work offering opportunity to men of varied talent.

*Published for the Communication Industry by*

**Western Electric Company**

**Makers of the Nation's Telephones**

*Number 66 of a Series*

## ATHLETICS

(*Continued from page 106*)

just managed to finish. Deiwert then ran the last half mile but could not overtake his man. Tech was awarded gold medals for their work. About an hour later Finlayson, Samuelson, Payne, and Deiwert ran the 2 mile medley but did not win a place. The team has been going very well in practice and it is expected that they will show up very well in the remainder of their schedule.

## TRACK

On January 28 some of the track team entered the I. A. C. Handicap meet at Broadway Armory. Don Skaer, a letter man from last year, won a third in the standing broad jump and in the standing high jump. A two mile relay team of Long, Payne, Deiwert and Samuelson ran against Ames and Notre Dame but could not stand the fast pace and had to be content with third.

On February 17 the team had a dual meet with Crane at Bartlett Gym which ended in a 27-27 tie. Captain Navarro, a former Armour man now attending Crane, and Deiwert were tied for high points with two firsts apiece. Deiwert won a slow mile and then came back to cop a 2:05 half and establish a new school record. The six events held were as follows:

| | |
|---|---|
| 50 Yd. Dash | Lattman (C)<br>Long (A)<br>Dolnick (C) Time :06 |
| 50 Yd. H. Hurdles | Navarro (C)<br>Kara (A)<br>Bookman (C) Time :07 |
| 1 Mile Run | Deiwert (A)<br>Payne (A)<br>R. Schuler (A)<br>Time 5:06 |
| 440 Yd. Run | Long (A)<br>Bauman (C)<br>Tracy (A) Time :53 1/5 |
| 880 Yd. Run | Deiwert (A)<br>Robinson (C)<br>Long (A) Time 2:05 |
| High Jump | Navarro<br>Bookman<br>Temple 5:07 |

Several meets have been arranged by manager Greenfield. As usual, a great number of men are needed for all the events. It is unlikely that the all-around will be held this year but the inter-fraternity meet will be held at Ogden field on April 13. All of the standard events with the exception of the two mile will be held in their regular places. Four places will count in each event. It is expected the meet will start about four o'clock.

## BASKETBALL

The basketball season is very nearly over. The season can not be called a success but through most of the games the team has displayed a grim fighting spirit that is a credit to the Tech standards. In no case have the games been easy or with weak opponents. Quite a number showed up for the first few practice games but after that, somehow they drifted away till a bare handful were left. A great deal of credit must be given to those who remained loyal throughout the season. The usual lineup was Kuffel and Eisenberg at the forward positions, Brumund at center, and captain Augustine and Hoffer at guards. In addition to these, Tavelinsky and Tell played on the first team. Tell is our frosh center who can neither hear nor talk but he played the game like a veteran. He can well be pointed to as an example for the school to follow. Fabian, Reifler, and Egan were used more or less all season. In addition to these, Manz, Lewis, Ross, Williamson, and Goodheart, while not getting in many games, stayed out the whole season. That is the spirit we like to see at Armour.

Here are a few of the high spots of the season. On January 5 some of the alumni came back to get trimmed. While they were in, they played a great game. The team was McLaren, '26, Kuehn, '21, McCaffery, '22, Erickson, '20, Johnson, '22, Albeck, '20 and Brockman who was out of school the past semester. The score at the half was 11-10 and finally ended 26-23 for Tech.

In the Carroll game here, the team gave us some real thrills. The game started out

Standing: Goodhart, Lewis, Reifler. Sitting: Tavelinsky, Brumund, Augustine, Eisenberg, Brockman.

by Armour getting a basket and then the score went to a tie at 10-10. At this point Tavelinsky came in and sunk a basket and soon the score was again tied at 12-12. The half ended 22-14 in favor of Carroll. From then on the game see-sawed around with some wonderful playing on both sides. Carroll has had championship teams the past few years so that we may consider our 35-27 score a good showing.

| | | |
|---|---|---|
| Jan. 5, | Armour 26 | Alumni 23, at Armour |
| Jan. 8, | Armour 16 | Carroll 39, at Waukesha. |
| Jan. 12, | Armour 16 | Lombard 22, at Armour |
| Jan. 14, | Armour 12 | Augustana 23, at Armour. |
| Jan. 22, | Armour 18 | N. I. S. T. C. 17, at DeKalb. |
| Jan. 24, | Armour 24 | Crane 21, at Crane. |
| Jan. 26, | Armour 36 | Lake Forest 12, at Armour. |
| Jan. 28, | Armour 27 | Carroll 35, at Armour. |
| Feb. 3, | Armour 31 | St. Mary's 34, at St. Mary's. |
| Feb. 5, | Armour 14 | Kalamazoo 32, at Kalamazoo. |
| Feb. 11, | Armour 17 | N. I. S. T. C. 26, at Armour. |
| Feb. 17, | Armour 32 | Crane 30, at Armour. |
| Feb. 18, | Armour 28 | Lake Forest 33, at Lake Forest. |

In the last minute of the Crane game here, Brumund sank a basket to pull the game out of a tie and Tech won 32-30.

## BASEBALL SCHEDULE

These are the games now signed up. More will be arranged.

April 15, Chicago Tech. at Ogden Field.
April 20, Concordia College at Ogden Field.
April 22, N. I. S. T. C. at Ogden Field.
April 26, Lake Forest at Ogden Field.
April 29, Michigan State Normal at Ogden Field.
May 12, N. I. S. T. C. at DeKalb.
May 13, North Central at Ogden Field.
May 14, Alumni at Ogden Field.
May 20, Lake Forest at Lake Forest.
May 21, North Central at Naperville.
May 27, Michigan State Normal at Ypsilanti.
May 28, Michigan State Aggies at Lansing.

## ENGINEERING NEWS

(*Continued from page 107*)

### TESTING A DAM TO DESTRUCTION

Working on the assumption that, up to date, no accurate data has been obtained on the exact character and amount of the stresses in a concrete dam, the Engineering Foundation of New York recently sponsored the construction of a purely experimental dam at a cost of $100,000, which has been built on Stevenson Creek, 62 miles east of Fresno, California, and tests are now being made under the direction of the United States Bureau of Standards.

The dam is 60 feet high, 140 feet long on top and ranges in thickness from seven and one-half feet at the base to two and one-half feet from the 30-foot level on up to the top. Beginning with five feet of water, tests have been made by engineers up to the full 60 feet and plans for extending the dam up to 100 feet high at the same thickness and for making tests until the dam collapses are well under way. As the dam holds only five and one-half acre feet of water, only a little over an hour is required to fill it to the top. The water, as soon as tests have been completed, is released for irrigation purposes. W. A. Slater, engineer of the United States Bureau of Standards, has been supervising and recording the results of the tests, and he is assisted by a corps of eight young engineers from various universities.

The Stevenson Creek dam is said to be the only purely experimental dam of its type in America.

Tests are being made for all kinds of stresses and deviations, all the ordinary instruments for such purposes being used and rechecked with other specially constructed instruments used for the first time on this job. Variations in the structure of the dam and movements down to one millionth of an inch are being recorded. Tests are made for arch and cantilever strains. Strain gages buried two inches deep in the concrete of the dam register, through telemeters, on an instrument board beside the dam; clinometers are used for measuring deflections or movement of the dam under pressure; level bars are employed to record tipping over from the foundations; radius meters also measure deflection; and theodolites measure deflection by computing angle from points on the dam to points on bed rock.

These tests are made from all over and all through the dam, from top to bottom and from side to side. One thousand strain-gage points with 533 lines are employed; 150 electrical telemeters are used; 80 radiusmeter lines run from various points on the dam; 60 deflectometers, 60 clinometer stations, and 12 level bar stations are in use.

# START A TECHNICAL LIBRARY NOW

If you have not already done so, start a permanent technical library now, and add to it as rapidly as you can. You will find all the books on your profession that you acquire now will be valuable to you when you get on the job. An important source of material for your library is the booklets published by manufacturers of the materials you will later use in your work.

The Hercules Powder Company publishes educational booklets, some or all of which should be included in every engineering student's library. Look through this list, check the ones you wish, and they will be sent to you without charge.

These treatises were written by explosives engineers who combine theoretical knowledge with practical experience. They are authoritative, comprehensive, and up-to-date. And they are free.

*Tear out this coupon and mail it today*

HERCULES POWDER CO.
941 KING STREET
WILMINGTON, DEL.

Please send me, without charge, the publications checked:

- ☐ HERCULES EXPLOSIVES *and* BLASTING SUPPLIES
- ☐ DYNAMITE—THE NEW ALADDIN'S LAMP
- ☐ HERCULES BLASTING MACHINES
- ☐ SAFETY *in the* USE *of* EXPLOSIVES
- ☐ BLASTING *in some* AMERICAN COAL MINES
- ☐ CUSHIONED BLASTING *of* COAL
- ☐ EFFECT *of* CARTRIDGE DIAMETER *on the* EFFICIENCY *of* EXPLOSIVES
- ☐ BLASTER'S CALCULATING SCALE
- ☐ HERCULES ELECTRIC BLASTING CAPS
- ☐ DEEP HOLE BLASTING
- ☐ SHOTFIRING *by* ELECTRICITY

NAME

STREET

CITY AND STATE

*HERCULES POWDER COMPANY*
(INCORPORATED)
941 KING STREET WILMINGTON, DEL.

ALLENTOWN, PA.
BIRMINGHAM
BUFFALO
CHATTANOOGA
CHICAGO
DENVER
DULUTH
HAZLETON, PA.
HUNTINGTON, W. VA.
JOPLIN, MO.
LOS ANGELES
LOUISVILLE
NEW YORK CITY
NORRISTOWN, PA.
PITTSBURG, KAN.
PITTSBURGH
POTTSVILLE, PA.
ST. LOUIS
SALT LAKE CITY
SAN FRANCISCO
WILKES-BARRE

## RADIOACTIVITY

(Continued from page 97)

centrated form. For many years the price of radium was $120.00 per milligram but this price has been somewhat lowered since the war.

There are two methods of investigating the rays which are spontaneously emitted from the radio elements. For the corpuscular rays or streams of charged particles, the magnetic deflection method is used in the same way as for cathode and canal rays, the specific charge $e/m$ being measured. As we have seen the direction of deflection will determine the sign of the charge and the amount of deflection gives information as to the velocity and the value of $e/m$. The second important method of investigation consists in measuring the relative absorption of the rays in gases and solids, using the electroscope for detecting the rays.

In these ways it was found that the rays are of three types, called the alpha, beta and gamma. In Fig. 11 is shown the effect of a magnetic field in separating and analyzing the rays. A pencil of radiation from a radium source issues from a narrow slit, the magnetic field being applied perpendicular to the paper and directed downward. The gamma rays continue without deflection; the beta rays are deflected to the right showing that they carry a negative charge, while the positive alpha rays are deflected to the left and much less in amount.

The measurement of $e/m$ for the beta rays shows that these corpuscles are identical with the cathode ray electrons. They travel in definite velocity groups and vary in speed from 3/10 to 99/100 the velocity of light, i. e., from 55 to 184 thousand miles per second, the highest velocities ever attained by any known body. From the theory of relativity it is shown that the mass of a body increases with its velocity, this correction being negligible for all ordinary velocities and becoming effective only when the velocity is an appreciable fraction of the velocity of light. Experimentally it is found that the mass of these high speed beta particles increases in exactly the manner predicted from the relativity theory. In their passage through gases and solids the beta ray electrons follow a tortuous path suffering many collisions. In the course of these encounters with the gas molecules, a charge may be knocked from a molecule or may be attached to another, forming in the gas, ions, or carriers of current which are analagous to the ions in electrolytes. This ionization of the gas renders it conducting and the measurement of the ionization current becomes a measure of the beta ray strength of the source. Usually the rate of discharge of a gold leaf electroscope is used to measure the ionization current. Beta rays are absorbed by solid matter, the number passing through decreasing with the thickness according to an exponential law and also decreasing as the atomic weight of the absorbing substance increases. About one millimeter of lead will stop all of the beta rays from radium. The path of the beta rays through a gas has been beautifully illustrated by the cloud expansion photographs. Here the tracks of the electrons are shown by photographing the small droplets of moisture which condense about the ions formed by the beta rays. By impressing on the grid of an amplifying tube the impulse due to a beta ray it has been found possible to actually count the electrons emitted from the clicks in the telephone receiver.

The value of $e/m$ for the alpha rays shows that its mass is four times that of the hydrogen atom and that it carries a charge $2e$. Many experiments have confirmed these facts and show that the alpha particle is in reality the nucleus of the helium atom. These particles, being much more massive than the electrons, are more effective in ionization of gases and produce much greater currents. They travel with velocities of about 1/20 the velocity of light, and are completely stopped by a sheet of aluminum .006 cm. thick or 6 cm. of air, finally being brought to rest by many collisions. The alpha ray tracks are very easily photographed by the cloud expansion method, their tracks being much longer and straighter due to their great energy. In addition to counting the alpha rays electrically they may be counted visually by the scintillations method. When the particles strike a screen of zinc sulphide or diamond, and are examined under the microscope, tiny scintillating points of light are visible, one point corresponding to each impact. By this method the total number of alpha particles from radium has been counted and found to be $13.6 \times 10^{10}$ emitted per gram per second. The number was counted for a small solid angle and the total then computed.

An important relation connecting the range $R$ of the alpha rays in air and their velocity $V$ is expressed as follows:

$$V^3 = aR, \ a \text{ being a constant.}$$

From this relation the velocities may be easily determined from the distance traversed in air. In the course of their collisions with gas molecules the alpha rays give rise to a type of low speed electrons called delta rays, these rays being forced from the confines of the molecule by the force of collision. Removed from the influence of the parent atom, the electrons travel independently as delta rays. When the collision is a direct one with a nitrogen molecule, atoms of hydrogen are expelled with great velocities showing that the hydrogen atom is probably a constituent of the nitrogen being removed only by the action of an enormous force. This same effect has been observed with a number of other elements and has revived the old Prout hypothesis that all elements are composed of hydrogen.

The gamma rays are undeflected by the magnetic field and are very penetrating, having been detected through 30 cm. of iron. Roughly the beta rays are 100 times as penetrating as alpha rays, and the gamma rays have 100 times the penetration of the beta rays. These gamma rays are similar to light and X-rays, consisting of electromagnetic pulses of very short wave length. They are only produced with the emission of beta rays and are thus seen to be a natural sort of X-ray.

Wave lengths of the gamma ray spectrum have been measured with the crystal grating but contain wave lengths much too small to be measured in this way. For these extremely high frequencies the corresponding wave lengths have been calculated from the energies of the beta rays emitted, there being a simple relation connecting these two quantities.

The gamma ray has a wave length of about 1/10 billionth of a centimeter. The extremely penetrating *Cosmic rays* recently detected may go far below this value in wave length. The gamma rays also produce ionization by the ejection of electrons from the gas molecules in a photoelectric action. The action of the gamma rays causes many salts to the fluoresce, chiefly zinc-sulphide, barium platino-cyanide, and calcium tungstate. In the measurement of radioactive substances, the unit of comparison is ionization of air or gamma ray activity of one gram of radium in equilibrium with its products. This unit of activity is called the *curie* and all radioactive substances are measured by comparing the rates of discharge of an electroscope with the standard substance, screening out all ionizing rays except the gamma rays.

Apart from the properties of the rays themselves, there are several fundamental experiments which throw a great light on the real nature of radioactivity. For these experiments a few centigrams of radium chloride sealed in a glass tube may be used:

1. Very small quantities of two gases —helium and a new gas called *radium emanation* gradually accumulate within the tube and may be detected by the spectroscope or by micro-gas analysis.

2. A deposit of lead is formed on the walls of the tube.

3. The tube always has a slightly higher temperature than its surroundings.

This latter fact we may now explain

(Continued on page 114)

# Refrigeration Engineers Prefer *Armour's* *Anhydrous Ammonia*

ARMOUR'S Anhydrous Ammonia is made from aqua-ammonia, a by-product of the coking industry, and is guaranteed to be absolutely pure, dry and volatile—absolutely free from foreign substances. It is economical because its purity assures the removal of all possible heat units at a minimum operating expense. Every cylinder is tested before shipment, and is shipped subject to your evaporation test before using.

For these reasons, leading authorities have held Armour's Anhydrous Ammonia to be the most efficient as well as the most practical medium for refrigeration purposes.

Skill, long experience and superior equipment combine to give it a quality that is not excelled. Fifty pound, one hundred, and one hundred and fifty pound cylinders are carried in stock at all principal shipping points.

*Write for Full Particulars*

ARMOUR AMMONIA WORKS

*Owned and Operated By*

**ARMOUR AND COMPANY**

CHICAGO

## RADIOACTIVITY

(Continued from page 112)

from the energy given up to the walls of the tube through the stoppage of the alpha particles and a few beta and gamma rays.

Initially the tube contained only radium and chlorine in the form $RaCl_2$. After a few weeks we find the element helium and solid lead, in minute quantities, and a new gas called radium emanation. This new gas does not react chemically with any known substance and from this fact and the similarity of its spectrum with that of helium it must be listed as one of the rare gases. It is found that the helium and lead are formed in quantities which are proportional to the time while after about thirty days the emanation reaches a maximum value and remains constant. It is then said to be in equilibrium with the radium. If this gas is removed from radium all the properties are the same except that the quantity of the gas decreases exponentially with the time while the radium remained sensibly constant in amount. In explanation of these properties we must conclude that the radium in the tube has been transformed into at least three new substances one of them being a new element.

Without exception, it has been found possible to explain all these phenomena and many additional and related ones on the basis of a new and novel hypothesis; namely, that of the disintegration of the atoms of chemistry. So far we have seen that the radium breaks up in some way giving rise to an atom of emanation; the emanation in turn must be constantly breaking up since when isolated it decreases in amount and this breaking up, possibly through a series of changes, finally gives rise to lead. In the meantime the rare gas helium is generated and is proportional to the number of atoms breaking up.

This disintegration may be described very simply by a law which holds true for all radioactive substances and is known as the Law of Transformation: "The ratio of the number of atoms breaking up per second $dN$ to the total number present at that time $N$ is equal to a contant." In an equation:

$$dN/N = k.$$

This equation means simply that the probability of any atom breaking up in a certain instant is always the same. Integrating this expression we find

$$N = N_0 e^{-kt}$$

where $N_0$ is the number of atoms present when the time is started. This law of radioactive decay has been beautifully demonstrated from experiment.

From these decay curves it is possible to measure the life of the emanation which has collected in the tube. The lives of various radioactive substances are usually expressed in terms of their half-lives, that is, the times taken for the number of atoms to decrease to one half their initial value. It may be simply shown that this half-life depends only on the $k$ in our equation so that from the decay curve the half-life may be determined. There are many other methods of deriving this quantity: from the counting of alpha particles, from the range of the alpha particles, and from the law of radioactive equilibrium. This latter condition of equilibrium depends on the fact that when one atom disintegrates and gives rise to another, this second atom usually breaks up and forms a third and so on. When the number of atoms produced equals the number breaking up the amount of the intermediate product remains constant and we have the condition:

$$dN_1 = dN_2 \text{ or } k_1 N_1 = k_2 N_2$$

so that, knowing the value of $k_1$ and the ratio of the amounts in equilibrium $N_1/N_2$, we may solve for $k_2$ and thus determine the life of the atoms $N_2$. In these ways the half-life of the emanation is found to be 3.85 days while that of radium is 1750 years. In old uranium minerals there is always a certain ratio of the uranium to the lead present and from this ratio and the half life of uranium it is possible to estimate the age of the earth. The values range from eight million to one billion years, from different methods. From the energy of the radiations a rough idea may be obtained of the period of a product, in general the more violent the activity the shorter the life. This fact has been expressed in a definite law connecting the half life with the range of the alpha particles and from this law lives of extremely short duration have been detected, which would have otherwise been immeasurable; for example, Florium C has a half-life $\frac{1}{10^{21}}$ seconds.

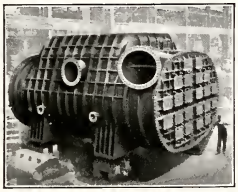
We now have the information necessary to detect all the different substances making up our radioactive families. Starting with uranium which emits alpha particles we find the parent atom disintegrating, forming several new substances and finally becoming radium. The radium emits radium emanation, the emanation *RaA* and so on through a series of so called active deposits each consisting of a definite substance, until we have *RaG* which is the final product and chemically similar to ordinary lead.

These radioactive processes show that the atom itself is complex consisting of electrons and protons in various combinations. After some unsuccessful attempts, Sir Ernest Rutherford put forth the hypothesis that the atom consisted of a very small and massive positive nucleus, made up of both electrons and protons but containing an excess of protons; around this nucleus electrons revolved in different elliptical orbits being equal in number to the charge on the nucleus, so that the whole atom retained its electrical neutrality. This picture then is one of a tiny solar system with the massive nucleus forming the sun and the electrons the planets, each planet revolving about its sun according to perfectly definite laws. If this picture is to be satisfactory, the entire mass of the atom must be contained in it nucleus, the electrons being of negligible mass. To test this picture the swift alpha particles from radium products were fired at the atoms contained in a thin film of gold leaf. Now the alpha particles are positive particles of a definite mass of 4 and the gold atom nuclei on this picture would be positive particles of a mass 197. With this information it can be shown that the alpha particle should describe a hyperbolic orbit about the gold nucleus and that the number of alpha rays scattered in this way through any angle could easily be calculated on the basis of the well known inverse square law of force. The results of this test were in complete agreement with the nuclear theory of the atom.

These experiments show the entire mass of the atom to be concentrated in the nucleus and that the order of diameter of the gold nucleus is $3 \times 10^{-12}$ centimeters, or about one ten-thousandth of the diameter of the outermost electron ring as obtained from other sources. Further, that the Coulomb law of force is at least very nearly valid within distances of about $10^{-13}$ centimeters of the nucleus. When we reflect that the gold atom is 197 times as heavy as that of hydrogen it is clear that the hydrogen atom is of extremely small dimensions, probably about one two-thousandth of the diameter of the electron, and that interatomic spaces are relatively large. This extremely small and massive nucleus, made up of protons and electrons and combinations, such as alpha particles, may in the course of building up the more heavy atoms finally reach an unstable condition and it is not improbable that this increasing instability accounts for the phenomena of radioactivity.

Using this solar system model of the atom, Bohr has applied the quantum theory and has succeeded in explaining the origin of spectrum lines. The special assumption made by Bohr is the allowance of only certain possible elliptical or circular orbits of rotation for the electron. The atom radiates energy when the electron, excited in some way, passes from one orbit to another. This energy then is created in jumps instead

(Continued on page 116)



## *Allis-Chalmers Condensers*

are built in the surface, jet and barometric types, in all sizes, and include a complete line of condenser auxiliaries.

The 52,000 square foot surface condenser shown above is operating with the 35,000 K.W. Steam Turbine Unit at the Waukegan Station of the Public Service Corporation of Northern Illinois; also a 32,000 sq. ft. condenser with the 25,000 K.W. Unit. A 57,000 sq. ft. condenser is now being installed with the new 50,000 K.W. Unit.

These three large generating units, condensers and auxiliaries, together with transformers and Reyrolle Armorclad Switchgear in this station are of Allis-Chalmers manufacture, another example of Allis-Chalmers "Undivided Responsibility."

**ALLIS-CHALMERS MANUFACTURING CO.**
**MILWAUKEE, WIS. U.S.A.**



# LALLY COLUMNS

*are*

Steel-Shell,
Concrete-Filled
Building Columns
*with*
Steel Caps and Bases

*Dependable*
*—Economical*

Have Given Satisfaction
for 29 Years

*Prompt Shipment*

LALLY COLUMN CO.,
OF CHICAGO
4001 Wentworth Ave.,
CHICAGO, ILL.

Boulevard 5871-72

·LALLY COLUMN·
·Stack Construction·



KEYSTONE COPPER STEEL

## Steel Sheets that Resist Rust!

The destructive enemy of sheet metal is *rust*. It is successfully combated by the use of protective coatings, or by scientific alloying to resist corrosion. Well made steel alloyed with Copper gives maximum endurance. Insist upon

# KEYSTONE
## Rust-Resisting Copper Steel
# Sheets

*Black and Galvanized*

Keystone Copper Steel gives superior service for roofing, siding, gutters, spouting, culverts, flumes, tanks, and all uses to which sheet metal is adapted—above or below the ground. Our booklet *Facts* tells you why. We manufacture American Bessemer, American Open Hearth, and Keystone Copper Steel Sheets and Tin Plates.

**Black Sheets for all purposes**
**Keystone Copper Steel Sheets**
**Apollo Best Bloom Galvanized Sheets**
**Apollo-Keystone Galvanized Sheets**
**Culvert, Flume, and Tank Stock**
**Corrugated Sheets**
**Formed Roofing and Siding Products**
**Automobile Sheets—all grades**
**Electrical Sheets, Special Sheets**
**Deep Drawing and Stamping Stock**
**Tin and Terne Plates, Black Plate, Etc.**

Our Sheet and Tin Mill Products represent the highest standards of quality, and are particularly suited to the requirements of the mining, engineering, and general construction fields. Sold by leading metal merchants. Write nearest District Office.

American Sheet and Tin Plate Company
General Offices: Frick Building, Pittsburgh, Pa.

DISTRICT SALES OFFICES

Chicago Cincinnati Denver Detroit New Orleans New York
Philadelphia Pittsburgh St. Louis

Pacific Coast Representatives: UNITED STATES STEEL PRODUCTS CO., San Francisco
Los Angeles Portland Seattle

Export Representatives: UNITED STATES STEEL PRODUCTS CO., New York City

## RADIOACTIVITY

(Continued from page 114)

of continuously and obeys the quantum relation,

$$W = hv$$

where $W$ is the energy radiated of frequency $v$, and $H$ is a universal constant. This theory has been remarkably well confirmed in the case of the hydrogen spectrum and has accounted for the lines in the X-ray spectra of the elements.

The simplest atom is that of hydrogen with one proton as nucleus and one electron revolving about it, the nuclear charge or atomic number being one unit. The next atom in the order of increasing atomic weight is that of helium. Here we find a nuclear mass of four units and a charge of $2e$ about which revolve two electrons in a very stable configuration. This helium nucleus is in every respect identical with the alpha particle from radium. To explain this structure of helium we may picture the nucleus as made up of four hydrogen nuclei, which will account for the atomic weight of four, holding these protons together. We have two electrons which do not add appreciably to the mass but leave a net charge of plus two, by neutralizing two of the proton charges. And so we may proceed through the periodic table building up our atoms from electrons and protons and alpha particles, our elements differing not in fundamental constituents but only in number and arrangement of the units. The periodic table is now arranged, in general, in the order of increasing atomic weight but the fundamental test as to position is the atomic number, which is given by the charge on the nucleus or the number of external electrons attached to the atom. Aid in determining this number is given from X-ray spectra, the frequencies of which are functions of the number. That the order is not always the same is illustrated by the case of argon and potassium. In the order of weights, K comes first with 39.10 followed by Ar of weight 39.88, however, the atomic number are reversed, giving Ar number 18 and K 19. This arrangement is much more satisfactory in the column grouping of the table in which the vertical columns have similar chemical properties.

This number then serves to identify the atom for most of its physical and chemical properties, since these are found to depend on the number of these extra-nuclear electrons. The mass, to be sure, depends upon the nucleus but we may easily picture atoms differing in mass but possessing the same atomic number through a slightly different arrangement in the nucleus. These atoms should possess the same chemical properties for they will attract the same number of extra-nuclear electrons but differ in atomic weights. Atoms of this kind are termed isotopes and are found to exist as a more or less general property of all elements, the tendency being for the component isotopes which give the combining weights to have their weights expressed as whole numbers. An example of isotopes is found in the case of *RaB, RaG*, and ordinary lead all of which have the same atomic number but respective weights of 214, 206 and 207.2. When the X-ray spectrum of lead and *RaB* gamma ray spectra are compared, they are found to be identical. The use of the mass spectrograph has developed the study of isotopes into an entire branch of physics.

As the picture is extended to the heavier atoms it becomes increasingly complex until we come to the most massive known element, that of uranium, having a nucleus of mass 238 and 92 electrons revolving about it. As the problem of three bodies has never been completely solved it becomes evident that the analysis of the motions of this solar system is one of monumental difficulty.

We may now outline briefly the method of radioactive production of new elements. Since the nucleus determines the character of the atom, both through control of the mass and the number of external electrons, any change therein will automatically change the atom either into an isotope or a chemically different element. Thus in radium we have a spontaneous method of accomplishing this nuclear disruption. Now radium has an atomic weight of 226 and an atomic number of 88. When an alpha particle is ejected from the nucleus, a mass of 4 units and a charge of plus 2 units is lost. Thus the residual atom becomes that of the emanation and should have an atomic weight of 222 and a nuclear charge of 86. This theoretical prediction of the atomic weight of the new inert gas agrees almost exactly with the experimental determinations made and the spectrum analysis shows it to have the number 86 and to belong in the group of nible gases. In turn the atom of emanation breaks up, emitting an alpha particle, and becomes an atom of *RaA* with a mass of 218. *RaA* breaks up into *RaB* and so on through the radium series until we reach the stable *RaG* which has been seen to be an isotope of lead. Most of these new elements formed are invisible and unweighable but are known to exist through their types of radiations.

During this process many alpha particles are ejected from the nucleus, in fact $13.6 \times 10^{10}$ per second from a gram of radium. These alpha particles, after freeing themselves, easily attract two free electrons which immediately start their revolutions about the alpha particle and so form an atom of helium gas. Thus we have a simple interpretation of the production of helium gas. Although this helium nucleus is composed of protons and electrons it has itself never been disrupted, withstanding the most terrific bombardments and remaining intact throughout.

Here then we have taking place spontaneously a process whose secret has been vainly sought for centuries—the transmutation of the elements. Here locked into the atom, we are given through radioactivity, a glimpse of a source of energy which, had we power to control it at will, would probably change the entire social and economic conditions now in existence. In the radioactive atom is found the most concentrated form of energy known to man; a source of energy which the extremes of physical and chemical variations are powerless to influence. The highest and lowest temperatures attainable and the greatest possible variations of pressure produce no observable effect on the rate of transformation. And so even for these tiny solar systems we may say, "Blind to good and evil, reckless of destruction, omnipotent matter rolls on its relentless way."

## CHICAGO DEVELOPMENT

(Continued from page 87)

veloped to compete with the wooden pile, stone-filled structure in cost or flexibility of design for the purpose.

A very important addition to the lake front project is proposed for the near future which will be the connecting link between the lake shore drives of the north and south sides of the city will complete a twenty mile long route for through traffic with scarcely an intersection or stop. It involves a monumental lift bridge across the Chicago river near its mouth with long approaches on each side of the river which on the south side will be built partly within the waters of the lake.

## CENTRIFUGAL PUMPS

(Continued from page 90)

improvement in efficiency over a single stage pump of a lower specific speed. In figure 2, if pump No. 1 had been designed for a head of 100 feet per stage, its specific speed would have been 700 and its efficiency 50-75%. Its cost, however, would still greatly exceed that of a single stage pump for 200 foot head or less.

Users will find if they have any doubts concerning their installation that the reputable manufacturer is ready to offer his assistance in selecting the proper pump. He realizes that the centrifugal pump has definitely come into its own as a high efficiency machine and that only improper application can prevent it from demonstrating its superiority over other types of pumping equipment.

CHARLES W. HILLS CHARLES W. HILLS, Jr.

CHARLES W. HILLS

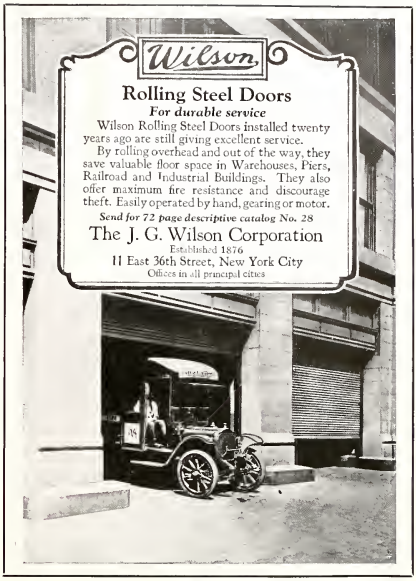
PATENT, TRADE MARK,
COPYRIGHT AND
UNFAIR COMPETITION LAW

1523-38 MONADNOCK BUILDING

CHICAGO

*Telephone, Harrison 6150*

*Cable Address Hillsford, Chicago*




**WIRE** automobile and airplane wires, electrical wires, submarine cables, bridge-building cables, wire rope, telegraph and telephone wire, radio wire, round wire, flat wire, star-shaped and all different kinds of shapes of wire, sheet wire, piano wire, pipe organ wire, wire hoops, barbed wire, woven wire fences, wire gates, wire fence posts, trolley wire and rail bonds, poultry netting, wire springs, concrete reinforcing wire mesh, nails, staples, tacks, spikes, bale ties, steel wire strips, wire-rope aerial tramways. Illustrated story of how steel and wire is made, also illustrated books describing uses of all the above wires sent free.

**AMERICAN STEEL & WIRE COMPANY**

*Sales Offices*

Chicago New York Boston Cleveland Worcester Philadelphia Pittsburgh Buffalo Detroit Cincinnati Baltimore Wilkes-Barre St. Louis Kansas City St. Paul Oklahoma City Birmingham Memphis Dallas Atlanta Denver Salt Lake City

Export Representative: U. S. Steel Products Co., New York

Pacific Coast Representative: U. S. Steel Products Company, San Francisco, Los Angeles, Portland, Seattle

*ALUMNI*
OF THE
ARMOUR INSTITUTE *of* TECHNOLOGY
ARE INVITED TO JOIN THE
COLLEGIATE CLUB *of* CHICAGO
*Over a half hundred* ARMOUR MEN *have already joined the* CLUB
(ASK THEM OR ANY ONE OF THE 1700 OTHER MEMBERS ABOUT IT.)
COLLEGIATE CLUB *of* CHICAGO
*Executive Offices*
510 PORTLAND BLOCK 35 NORTH DEARBORN STREET STATE 5836

Armour Institute of Technology
Chicago

The College of Engineering Offers Courses in

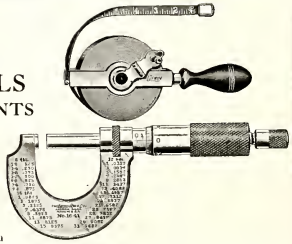
ELECTRICAL ENGINEERING
MECHANICAL ENGINEERING
CIVIL ENGINEERING
FIRE PROTECTION ENGINEERING
CHEMICAL ENGINEERING
ARCHITECTURE

*These courses are each four years in length and lead to the degree of Bachelor of Science*

COMPLETELY EQUIPPED SHOPS AND LABORATORIES

*The* Institute Bulletins
Will be Sent on Application

LUFKIN
TAPES, RULES, TOOLS
INSURE YOUR MEASUREMENTS
On Sale Everywhere
Send for Catalog
THE LUFKIN RULE CO.
Saginaw, Michigan
New York Windsor, Canada



*Please mention The Armour Engineer*

# Resists Corrosion

THIS picture, taken in the salt marshes near Kearny, N. J., shows two lines of 30-inch Cast Iron Pipe replacing pipe made of other material. The alternate exposure to the action of salt water and air is a severe test.

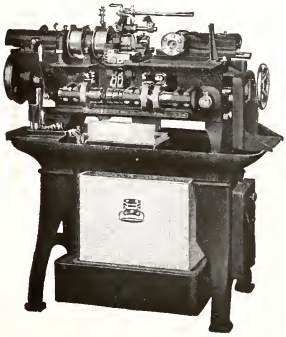
While the pipe shown in the picture is subjected to unusual corrosive influences, all underground pipe must be able to withstand corrosion to a greater or less degree. Cast Iron Pipe has this quality. It does not depend on its coating to resist rust; the material itself is rust-resisting. The first Cast Iron Pipe ever laid is in service today at Versailles, France, after two hundred and sixty years' service.

THE CAST IRON PIPE PUBLICITY BUREAU
Peoples Gas Bldg., Chicago

CAST IRON PIPE

*Our new booklet, "Planning a Waterworks System," which covers the problem of water for the small town, will be sent on request*

*Send for booklet, "Cast Iron Pipe for Industrial Service," showing interesting installations to meet special problems*



*Faster machines mean still lower costs to the consumer*

Although the average person seldom realizes it, when he gets a serviceable clock, safety razor, or any of thousands of articles in daily use, his thanks for their low cost are partly due the Brown & Sharpe Automatic Screw Machines. Their ability to keep costs down lies in their automatic operation and the rapidity with which they produce accurately formed parts.

And now, to further increase the production and to make the cost still lower on work similar to the pieces at the left, the Brown & Sharpe Mfg. Co., have placed on the market a line of High Speed Automatic Screw Machines. These machines operate with spindle speeds up to 5000 R.P.M. and are particularly suited for speeding up the production of parts made from the softer metals, such as brass.

Every student engineer should become familiar with these machines which hold so important a place in modern manufacturing. We are always ready to send at your request descriptive material covering these machines.

BROWN & SHARPE MFG. CO.
PROVIDENCE, R. I., U. S. A.

# KOEHRING

## —builds more than Pavers!

KOEHRING HEAVY DUTY

IN spite of the predominant position of the Koehring Paver among contractors in all parts of the country, it is not the only Koehring product.

The same organization which manufactures approximately 50% of the paving mixers used in the world builds Koehring Heavy Duty Gasoline Shovels and Cranes of the same dependability.

Rugged and sturdy, the Koehring Shovel goes ahead in dirt or rock, making deep cuts or tearing up old surfaces for the new, permanent highway that is to follow.

With fast, smooth action under Finger-Tip control the Koehring Crane with clamshell attachment transfers the aggregate from freight cars into stock piles. At the central proportioning plant it elevates the crushed stone, gravel and sand into bins where these materials are measured into batches before being conveyed to the Koehring Paver.

Every Koehring product built for dependable service!

*"Concrete — Its Manufacture and Use" is a 210 page treatise on the uses of concrete, including 26 pages of tables of quantities of materials required in concrete paving work. To engineering students, faculty members and others interested we shall gladly send a copy on request.*

KOEHRING COMPANY
MILWAUKEE WISCONSIN

*Manufacturers of* **Pavers, Mixers—Gasoline Shovels, Cranes and Draglines**

# He harnesses words to help sell electricity

E. L. Andrew

"Oh, St. Patrick was an engineer," lustily caroled the senior engineers at Wisconsin in the spring of '16. But to E. L. Andrew, St. Patrick has become the patron saint of merchandising and advertising as well.

Andrew liked engineering and had an excellent record in his work. But even in his high school days, he had been interested in writing. And that interest grew as he wrote for the annual, was successively editor and business manager of the Wisconsin Engineer, and was advertising manager of the Engineers' Famous Minstrel Show. He received his degree fully determined to harness words to help sell electricity.

At that time railroad advertising fascinated him. There was romance—and adventure—in the great tangle of tracks spread across the continent. So he applied and was accepted for a place in the Westinghouse Graduate Students' Course, hoping some day to do railroad advertising.

A month after he started the course he was made an instructor. For six months he had classes in the morning—then was free all afternoon to browse through the Westinghouse plant and learn those things that have made him valuable in the direction of Westinghouse advertising. But that's getting ahead of the story.

*"What's the future with a large organization?" That is what college men want to know, first of all. The question is best answered by the accomplishments of others with similar training and like opportunities. This is one of a series of advertisements portraying the progress at Westinghouse of college graduates off the campus some five—eight—ten years.*

Andrew left the educational department to be a requisition clerk handling requests for literature on Westinghouse irons, fans, toasters, percolators. Here he got his first glimpse of merchandising electrical appliances—an activity that was soon to rank with railroad electrification, marine engineering and the other important branches of the Westinghouse business. Andrew grew up with this development. He was one of the men who organized the merchandising section of the advertising department, which has remained under his charge since that time.

But his activities have been wider than this. Because of his understanding of both electricity and advertising, he was made assistant to the advertising manager, giving particular attention to national advertising. With the growth of the merchandising department, sales promotion also came under his charge.

Today he is manager of the sales promotion section of the merchandising sales department, head of the merchandising section of the advertising department, and assistant to the advertising manager.

To engineering graduates interested in technical writing and advertising, Westinghouse offers an opportunity for realizing ambitions to the full.

**Westinghouse**

WESTINGHOUSE ELECTRIC

# When lightning seems as slow as a glacier

It is easy to photograph a glacier because it moves but a few feet a year. But to photograph the effects of lightning on electric circuits—effects that come and go in millionths of a second—would seem impossible. Yet there is a man-made machine operated in the laboratories of the General Electric Company that does just this. It makes even lightning seem slow.

In the machine a swift-moving stream of electrons flashes across a photographic film. It dances out of its path when the freakish currents, caused by lightning, surge along the wires. There on the film is the footprint of lightning.

It has made possible a study of the working of a lightning arrester—the ingenious device that protects the costly equipment of the power house as well as the very lights in your home.

Upon such scientific achievements as the cathode-ray oscillograph—lightning's camera—is the confidence in General Electric equipment founded. Many of these achievements are better known. The modern developments in x-ray, the service that has made MAZDA lamps a staple of commerce, the modern small motor that has taken drudgery out of household work—these are some of the milestones of progress.

*Above is one of the photographs—oscillograms they are called. The jagged curve is produced by the lightning. The surge traveled at the rate of thirty miles a second but it was recorded, and in the amazingly short time of one-millionth of a second.*

610-19DH

# GENERAL ELECTRIC

GENERAL ELECTRIC COMPANY, SCHENECTADY, NEW YORK

# The ARMOUR ENGINEER

VOL. XVIII MAY, 1927 NO. 4

*Published Quarterly by the College of Engineering*
*Armour Institute of Technology*
*Chicago, Ill.*

*Member of Engineering College Magazines Associated*

*"What's the future with a large organization?" That is what college men want to know, first of all. The question is best answered by the accomplishments of others with similar training and like opportunities. This is one of a series of advertisements portraying the progress at Westinghouse of college graduates, off the campus some five—eight—ten years.*

# *Frenger Came Here to Sell*

R. F. Frenger

When R. F. Frenger was at New Mexico State, in 1915, automatic control for sub-stations, hydro-electric generating plants, railway and mine sub-station systems, was a hazy dream. Even five years later, when Frenger was working in the Switchgear Sales Section of the Westinghouse Company, automatic switching was far, far away.

Today, however, Frenger, still in his thirties, finds himself in effect the Sales Manager of an automatic switching business — a business that runs up into seven figures every year.

Frenger came to Westinghouse to sell. He expected to sell steam apparatus, since he had taken an M. E. degree.

After a period in the Westinghouse sales school, he became interested in switching apparatus. He spent months on the engineering side of the work. He spent several years as a sales specialist in the Westinghouse Chicago Office.

Then, as automatic switching grew in importance, Frenger grew along with it. Today he is head of the Automatic Switching Section of the Switchgear Sales Department.

Frenger's work is pion ering in a very real sense, for the automatic control business, lusty as it is, still is in its infancy. Engineering ways and means must be supplied as well as specialized sales skill. The whole world is the market.

Not long ago Frenger ran out to San Antonio to help the local Westinghouse salesman land an order that puts the San Antonio sub-stations under automatic control. When the Holland vehicular tunnel opens, and connects Manhattan with the Jersey shore, Frenger can point to the traffic signaling system as coming from his section.

At Cleveland one man in a downtown office building turns off and on eleven different sub-stations scattered throughout the city and its suburbs to operate the railway system — all without leaving his chair. Frenger's section again.

It is another case of a well trained man in a pioneering organization.

**Westinghouse**

WESTINGHOUSE ELECTRIC

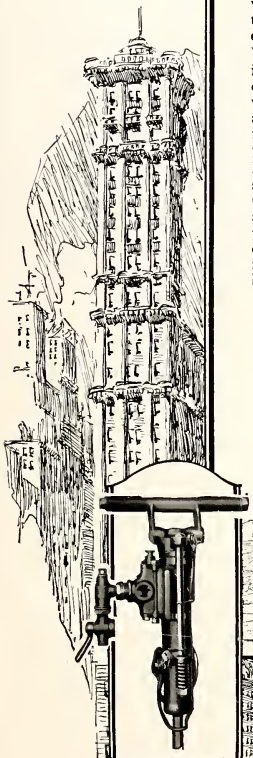
# The First Rock Drill

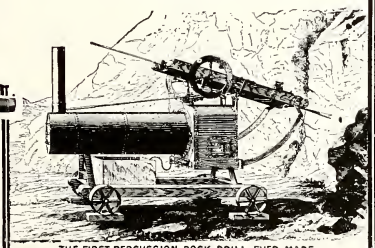
It is said about 42nd Street and Broadway that sooner or later nearly everyone passes that way. So when you are in New York, be sure to come on down to 11 Broadway and see Simon Ingersoll's first rock drill.

We of the I-R family find this drill a daily inspiration in our work, and enjoy showing it in its protecting coat of gold leaf to our college friends. Compared with the "Jackhamer" of today, which is 20 times as powerful, the first rock drill serves as a milestone from which to measure the progress made in compressed air engineering during the past half-century.

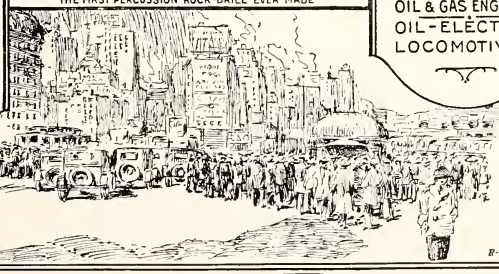
Nowadays, you will find I-R Drills and Air Compressors wherever rock is drilled, be it in New York, in the Orient, or in the South Sea Islands; and you will find an I-R representative within easy reach. You may possibly find that this representative comes from your own school. There are at least 1000 college graduates in the manufacturing, the sales, and the service branches of this world-wide organization.

INGERSOLL-RAND COMPANY
11 Broadway . . . . . New York City
*Offices in principal cities the world over*
For Canada Refer—Canadian Ingersoll-Rand Co., Limited, 260 St. James Street, Montreal, Canada





THE FIRST PERCUSSION ROCK-DRILL EVER MADE

INGERSOLL-RAND PRODUCTS
AIR AND GAS COMPRESSORS
ROCK DRILLS
DRILL SHARPENERS
PNEUMATIC TOOLS
TIE TAMPERS
CAMERON PUMPS
VACUUM PUMPS
CONDENSERS
AIR LIFT PUMPS
AIR HOISTS
OIL & GAS ENGINES
OIL-ELECTRIC LOCOMOTIVES



R-900

# Ingersoll-Rand

1902 1927

# Recognition, Reputation, Repetition

JUST a quarter of a century ago four young men, with a broad background of training and experience in the engineering construction field, formed The Foundation Company. Today the company is at work in every continent, in both hemispheres, and on both sides of the Equator, on engineering construction of almost every known type.

© Hamilton Maxwell, Inc., N. Y.

OVER FIFTY OF THESE LARGE BUILDINGS REST ON FOUNDATIONS BUILT BY THE FOUNDATION COMPANY IN NEW YORK

WATER PIPES BEING LAID BY THE FOUNDATION COMPANY FOR THE MUNICIPALITY OF CUZCO, PERU

DURING the early years the activities of this organization were centered on Manhattan Island and principally on its southern tip where foundation work was most difficult; now, subways in England, river control and land reclamation in Greece, bridge piers in Japan, a power plant in Venezuela, dredging in Colombia, and general construction of all kinds in Peru, are some of the many undertakings of magnitude engaging The Foundation Company, all over the world.

AS indicative of the service rendered by The Foundation Company over this period of years, these partial lists of repeat contracts have special significance. In one case no less than thirty contracts have been awarded by one owner.

| Cleveland Cliffs Iron Co. | | Pennsylvania Railroad | | U. S. Government | |
|---|---|---|---|---|---|
| Mine Shaft | 1909 | Bridge Piers | 1913 | Navigation Dams | 1911 |
| Power House | 1911 | Bridge Piers | 1917 | Gun Shrinkage Pits | 1917 |
| Power Dam | 1917 | Pumping Stations | 1918 | War Construction | 1918 |

## THE FOUNDATION COMPANY

### CITY OF NEW YORK

*Office Buildings*
*Industrial Plants*
*Warehouses*
*Railroads and Terminals*
*Foundations and Underpinning*
*Filtration and Sewage Plants*

ATLANTA
PITTSBURGH
CHICAGO
SAN FRANCISCO

LOS ANGELES
MEXICO CITY
CARTAGENA, COLOMBIA
LIMA, PERU

MONTREAL
LONDON, ENGLAND
BRUSSELS, BELGIUM
TOKYO, JAPAN

*Hydro-Electric Developments*
*Power Houses*
*Highways*
*River and Harbor Developments*
*Bridges and Bridge Piers*
*Mine Shafts and Tunnels*

BUILDERS OF SUPERSTRUCTURES AS WELL AS SUBSTRUCTURES

# THE ARMOUR ENGINEER

*Published Quarterly by the College of Engineering*

ARMOUR INSTITUTE OF TECHNOLOGY

Volume XVIII May, 1927 No. 4


## Table of Contents


Cover Design, a Drawing of the World's Largest Blast Furnace, by John William Urban, '27. (A description of this blast furnace appears in the Engineering News Section.)

Dedication ..... Frontispiece

A Farewell Address ..... 125
L. C. Monin.

An Expression from the Faculty ..... 128

The Students' Message to Dean Monin ..... 128

An Alumnus Says Farewell ..... 129

Building to Reduce Fire Losses ..... 130
C. K. Stiff.

The Status of the Illinois Waterway ..... 133
Murray Blanchard.

Business and the Engineer ..... 134
L. C. Thoelecke, '24.

A Letter to You from Europe ..... 135
Walter Hendricks.

The Armour Alumnus ..... 139
J. Warren McCaffrey, '22.

The Unofficial Observer ..... 140
J. C. Peebles, '04.



Published in November, January, March, and May by the College of Engineering, Armour Institute of Technology. Publication office: 3300 Federal Street, Chicago, Illinois. Subscription price, $1.50 per year, postage prepaid. Single copies, fifty cents.



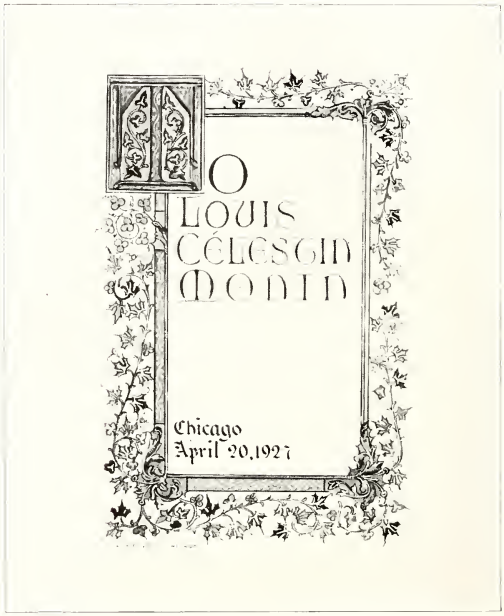
ENGINEERING COLLEGE MAGAZINES ASSOCIATED

*Chairman:* Professor Leslie F. Van Hagan, Madison, Wisconsin.

Armour Engineer
Colorado Engineer
Cornell Civil Engineer
Illinois Technograph
Iowa Engineer
Iowa Transit
Kansas Engineer
Kansas State Engineer
Michigan Technic
Minnesota Techno-Log
Nebraska Blue Print
Ohio State Engineer
Penn State Engineer
Pennsylvania Triangle
Princeton News-Letter
Purdue Engineering Review
Rose Technic
Sibley Journal of Engineering
Tech Engineering News
University of Virginia Journal of Engineering
Wisconsin Engineer

**We urge our readers to take advantage of the technical information that our advertisers will gladly furnish upon request**


COPYRIGHT, 1927, BY THE ARMOUR ENGINEER




Dedication

*The*
# ARMOUR ENGINEER

VOLUME XVIII | MAY, 1927 | NUMBER 4

## A FAREWELL ADDRESS

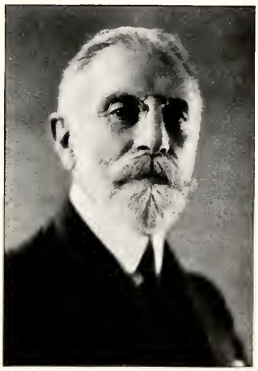
### By LOUIS CELESTIN MONIN

***Retiring Dean of the Armour Institute of Technology***

DEAN MONIN met his class in philosophy on the twenty-first of April and delivered his farewell address to the seniors. He spoke to them more as though they were already alumni, and as such, of their responsibility in carrying on the work of Armour. His opening remarks were more of a general nature, a resumé of the theme of his previous discussions. He stated that, "because of our meetings here we have discussed a hundred and one things of different aspects. I have tried to give you a perspective here and there; that is all we can do."

"All our problems we must settle, of course, ourselves. It is not in life as it is in your sciences. You have, in your sciences, in mathematics, in the laboratory, or in the shop, a problem to be solved according to the rules and the scientific knowledge which you may be able to apply. You are certain that you can solve the problem. There are hardly any unsolved problems in science; if one generation doesn't solve them, the next generation will. With life it is different. Neither your father nor your mother, your friends nor teachers, nor any philosopher, nor poet, can tell you exactly what methods you must employ to solve your personal problems. You have to find out yourselves. As the old teacher who was asked whether he taught religion to his classes, replied. 'No! Whatever we have in religion we grow ourselves.' And so it is with our happiness and with our success. We must grow it ourselves.

"I have been very, very happy the last few days in the knowledge that the time I have spent with you in the Institute has not been entirely in vain. There



Dean Monin

come to every man during his work and lifetime, moments when he doubts himself, when he doubts his friends, when he doubts the work he is doing when he is dissatisfied with everything, and again, there come crises and turning points in every man's life when he awakes and finds after all, he has had some results. I have some friends whom I shall never forget wherever I may go. It is the same with the Institute. When I said to Mr. Philip D. Armour that the entire alumni body, our friends, all those who have come to the Institute, and its reputation, would stand by us in our crisis, which you know we passed through a year ago, Mr. Armour said, 'I think you are mistaken, I think we have very few friends, but let us see, let us wait.' When the alumni were first approached on the maintenance fund, as you know, they guaranteed thirty thousand dollars annually, for the next four or five years, or until the affiliation with Northwestern University has been made. The actual subscriptions amounted to seventy thousand dollars annually, which I think is a magnificent testimony of loyalty and of success, because they are still the first generation that has left this institution. It is not like Yale or Harvard where the grandsons of alumni are today the trustees, or the students. It is already the third and fourth generations that are maintaining these institutions. You young men, and all who go out as students now, will make your careers, and make your marks in life, and by and by maintain your growing families. It means a good deal, gentlemen, even for a man who has a mighty good income to subscribe a thousand dollars a year for five years to an institution like ours. This is, after all, an impersonal affair where he gives his money, which is certainly hard earned, to a cause; the cause being the cause of unthinking young men and the perfection of engineering. I want to tell you as genuises who are soon going out from here, that you have a place in a group of about ten thousand. You have a place among those who are in the background watching. I am very happy to say that Mr. McCaffrey, who is one of these loyal fellows and whom the alumni have appointed as secretary, has a permanent position with an office here on the ground, to keep his eyes and ears open and see to it that the professors and the students keep to their work and do what is right, and keep up the spirit, the tradi-

tions, and the hopes of the Institute. Do not go away when you graduate, thinking that the thing is over, but rather turn the corner and think of many, many things; by and by of marrying, by and by another promotion, more salary, moving to a better street, buying a better car, adding a little boy, a little girl, and so on. These things will come in due time, but once in a while turn back with your delights and your cheer and hold tight in your heart to the old institution, to those who have gone before you whether you know them or not, an invisible company of good fellows and strong men.

"A young man graduated from here. He was not very strong, mentally nor physically, and I didn't have great hopes that he would come up rapidly. He had to make his way while he learned. I think I told you he was a construction engineer in one of the government departments with a pretty fair salary; a fine fellow. He said in a letter to me, "My chief is also an Armour man.' The chief structural engineer of the department is Mr. Falk of '06. I remember I used to say, 'Straighten up, Falk, because you can't do your work like that.' And Falk has made good. He is a cerdit to the Institute. On the other hand, his mind had come back here and he stood back of the Armour Institute of Technology in a very modest way and gave us a magnificent collection of photos and drawings.

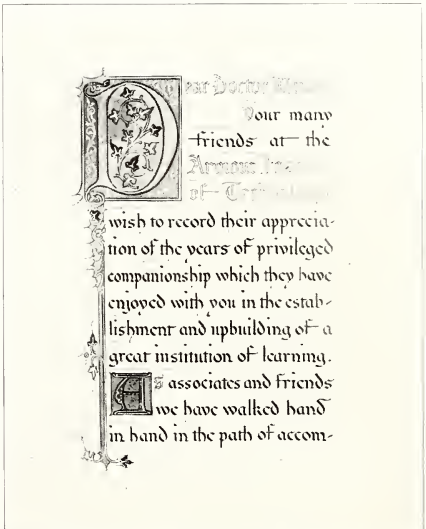
"Now, gentlemen, I say to you here, do not cut the strings when you graduate at the end of this semester but hold up, mentally and in your hearts, to the atmosphere; help with your hopes and with your sympathetic relationship to the Institute; help in effecting this affiliation with Northwestern so that the Institute does not suffer in any way from being—I didn't say dominated—interfered with a little by the large university that is on the north shore, who have their own plans, their own ideas, and their own methods. We should move on with our own plans and methods if possible, in a friendly relation of course, but we want the Armour Institute of Technology, not to be absorbed by the large institution, but coordinated. You will have to help preserve our ideals, our methods, our type of mind, our type of boys, and our type of character as best you can—just as you will find when you are out in life, when you are thrown into the maelstrom of our busy, hurrying civilization, you must preserve your own character, and your own type of mind, and stand firm on your convictions.

"I want to excuse myself, and thank everybody, especially our authorities, for their kindness in letting me go before the end of the semester. It is not setting a good example at all. If you as students wanted to go before the end of the semester, I would say 'No!' But, you know the point is this, when you work up a good report you can have time on it. Once in a while it helps to have a good report, and I find, my friends, that my report is all right. I can cut this semester off short. I would be only too happy to go to the Mission with you and give every one of you his diploma. However, I asked for the privilege of signing them here and you will find my name on your diploma with all my good wishes for your success and for your happiness.

"Dr. Raymond wanted me to tell you what the arrangements will be in the Dean's office after I have gone. In the Dean's office, gentlemen, there is to be a change which will not affect you, but in which you are interested. Professor Palmer, of the mathematics department, whom you all know and respect, will come in the office as acting Dean of Students, and Professor Penn will be acting Dean of Engineering. As you know, Professor Penn has been in the office for a good many years, and he knows the ins and outs of the profession. He has the experience in the mechanical part of grinding out grades and figures. In grinding out the averages one day, he said to me, 'How do you select the right grade for the right fellow?' I said that I would look at him and if he seemed a likable fellow, I would give him a good grade. 'But the fellows average 90, 90¼, and 90¾; now which one of these three must we take?' You take 90¾; in life that is wrong, in engineering that is all right. Do figures talk? Figures are powerful, unfortunately. If a fellow is a hundred dollars in debt, he is a hundred dollars in debt; no talk nor illusion will get him out of it. Professor Penn knows all the schedules, and makes all the different arrangements for the professors and for the students. Some don't want the first hour in the morning, just as you, but they have to be there. That is all up to Professor Penn. Professor Penn, as you know, originally is from Holland. He is a Dutchman, and a Dutchman has a backbone just as straight as a tree. He is dependable and, as some of you know, if you get up against Penn, you know he is there.

"Professor Palmer, as acting Dean of Students, will have the students and the student relations at heart. Students will come to him with all their trials and tribulations or to tell him, as they used to tell me, when they become engaged. If you meet failure in a subject and you think you should have a passing grade in that subject, he will weep with you. If you have a complaint against any of the professors, he will sympathize with you; and in order to keep a proper balance in the Dean's office, Professor Penn will sympathize with the professors.

"If in your associations, your clubs, and in your fraternities especially, you have any influence, which, of course, seniors always have, I wish you would inform our friends and our students of the change, and tell them that for guidance in whatever affects the individual work and life of the students, the different dances and functions of the fraternities, they should go to Professor Palmer. He is of a sympathetic nature,




A Reproduction of the Testimonial Presented to Dean Monin by

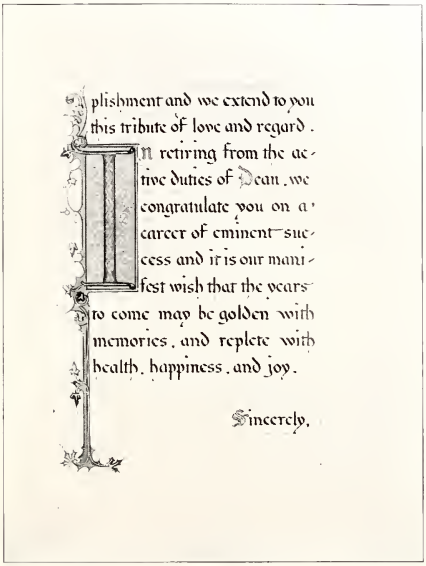
and is a quiet man. He doesn't easily lose his temper, as I used to once in a while. He has a son of his own who is now a student in the University of Illinois. He knows just about how much money to send him, what he will need, and what he will not need; how much the boy should study, and how much pleasure he should have. His son is a good boy, especially good in mathematics, naturally. I think no father who is a teacher of mathematics would say otherwise.

"The Executive Council that we have had for so many years will no longer exist. Instead of that, the trustees have appointed the heads of all the departments the Deans, and the Director of Evening Classes as a committee, the Committee on Educational Policy. They will discuss all matters concerning our educational policy. This covers the distribution of subjects, whether physics should come in the sophomore year or in the senior year, whether we have too much calculus or not enough, whether we should have fewer drawing periods or more. All of this was formerly designed, of course, by the Executive Council. President Raymond, in many ways, on account of the disbanding of the Executive Council, will have more responsibility on his shoulders.

"Remember your college. You have a President. You have next to the President, with their advice and help, Professor Palmer as Acting Dean of Students and Professor Penn as Acting Dean of Engineering. Next to these as advisors you have the Committee of Educational Policy, and next to that you have the individual head of each department, who will have, perhaps, a little more authority and a little more responsibility.

"It has heretofore been the custom to lay everything that comes up to the Dean's office, whether it has been their fault or not. A few years ago a pipe burst in the chemical laboratory. A professor came and interrupted me, saying, 'Professor, a pipe has burst.' 'Stop it,' I said. Or a professor would come over from the mechanical department saying a boiler was leaking, or so and so was wrong, making the office a perfect hubbub. A boy once came in and said, 'Professor, I am going away; I am afraid I will be away about a year or longer. You know I am engaged. While I am away, wouldn't you call, once in a while, upon my girl?' What would you answer to things like that? I said to him, 'Do you trust me to that extent?'

"And then Mr. Allison comes in saying, 'You have spent so much for the library this year, and so much last year, and it has amounted to so much more this year than last year. What can you do about it?' And then Miss Steele brings in a large order for books. 'My heavens, did you figure how much that means, Miss Steele?' 'Why, no, how


plishment and we extend to you
this tribute of love and regard.
In retiring from the active duties of Dean, we
congratulate you on a
career of eminent success and it is our manifest wish that the years
to come may be golden with
memories, and replete with
health, happiness, and joy.
Sincerely,

His Friends at the Armour Institute of Technology

much is it?' And then Professor Gebhardt comes in with a very much needed order, must have it right away; and Professor Finnegan wants a new copy; and Professor McCormack, why, these chemicals just eat up books. Then I hear from Mr. Allison again, and that's the way it goes.

"And then comes Professor Doubt. 'Haven't we received that measurement book yet?' 'No, Professor Doubt, I'm sorry.' 'Well, I wish you would hurry it up.' 'Alright, Professor Doubt.' And I know I threw the requisition card away two weeks before that. In time Professor Doubt forgets about the book. A view of the inside, gentlemen. And here come our boys with, 'Why don't we play football?' Football costs a lot of money the first year, and we haven't got it. 'But don't we pay a student activity fee?', they ask. Yes, student activity fee, but, my heavens, they all clamor for it. The publications want it, and athletics want it, and there is no telling what is coming. Fifteen dollars, gentlemen, is not very much after all, and yet for many men it is too much. What are you doing, gentlemen, what are you going to do? When you have a dollar for a dinner, and the public and the students expect you to give them a banquet that costs ten dollars, what are you going to do? There are a lot of improvements needed, for example, the lockers. Already this year we have spent on the library three times as much as last year. This is just to give you an idea of conditions. The professors' salaries should be raised, and the apparatus should be replaced, and this and that replenished. But what has been our salvation? Our salvation and your salvation has been hard work. Hard work is a fine blessing. The other way, the lackadaisical, easy-going way is not right, so don't begrudge the years which you have given to hard work here. The hardest work is the work of our President who has all the problems on his shoulders and will have more in the future.

"Now, we have come to the parting of the ways. When a man is seventy, and has a few more years perhaps in which to enjoy himself, he had better take them. I feel just like a passenger on the Pullman when the porter comes through from the dining car saying it is the last call for dinner. It is about the last call and, of course, Mrs. Monin and I shall find it more enjoyable abroad. If I get as homesick as I was five years ago, I will come right back to 3300 Federal Street.

"I thank the senior class again for the delightful hours you have given me. You have been sympathetic with me, you have been patient with me. Don't lose your temper; keep your good humor; it is your salvation in life. When you feel like worrying, or weeping, or running away, simply ask Dr. Raymond, or Schommer—he knows a lot of funny stories—to get you out of this rut and this dust.

"So, thank you, God bless you, and give you success."

# An Expression from the Faculty

THE departure of our beloved Dean Louis Celestin Monin from our midst has filled the heart of every member of the faculty with deep regret and sorrow. It seems like a great bereavement. We realize that each of us has lost a true and loyal friend to whom we might ever bring our confidences and troubles, knowing that we would be certain of guidance and understanding at all times. Untiringly he labored in our behalf. The humanness of the man endeared him to all who came to know him.

We also realize that a great educational leader has left us and that we shall miss this leadership at this important juncture in the development of the Armour Institute. Dean Monin came to the Institute at the very opening of its doors and took an important part in shaping its policy. In the early days he was Dean of the Armour Scientific Academy until he was made Dean of the Cultural subjects while Professor H. M. Raymond was Dean of the Engineering subjects. Upon the death of President Gunsaulus, Dr. Raymond became President while Dr. Monin was made Dean. It seems tragic that Dean Monin should not see the crowning of his life-work and of his dreams in the completion of the greater Armour Institute. Like another Moses he came to the verge of the Promised Land without entering it. However, he may have the satisfaction of realizing that his work contributed much to making this greater institution possible.

Dean Monin brought to the Armour Institute the finest culture and the highest ideals of Europe. He had studied at the great universities of Heidelberg, and Leipzig, under such masters as Kuno Fischer, Wilhelm Wundt, and others. His learning was very comprehensive. He had studied philology, economics, philosophy, art, history, and other subjects, even the study of medicine having at one time engaged his attention. His scholarship was thorough and profound. Being able to speak fluently French, German, and Italian, as well as English, he was able to study the literature of many nations in the original language. As a young man he had traveled very extensively, spending much time in Germany and Italy as well as in his native Switzerland. These were wonderful opportunities which he used to the full. His fine manners and striking personality stamped him a leader among men. He was an interesting conversationalist and his rich experience gave authority to what he said. It was a wonderful opportunity for our students to hear the lectures of so great a teacher. He had a need to give unto others what he had gathered, and enjoyed being before an audience. Many of the Chicago teachers enjoyed the opportunity of listening to his lectures on Psychology and the History of Education and none of his students ever forgot him. He had several opportunities of accepting other positions but always remained loyal to Armour Institute. In the last addresses he made to the faculty and also to the various classes he stressed this idea of loyalty to President H. M. Raymond and the new Deans Penn and Palmer. It was this sincerity and whole heartedness that explains his remarkable hold upon men.

And now as our good friend Dean Monin departs from us, we wish to assure him of our undying gratitude and affection. In the highest and best sense he will still belong to the Armour Institute and to us though an ocean may separate us. Ties as strong as those which bind him and us together can not be broken by distance or even by death. Dean Monin imparted his spirit to us and this spirit will continue to guide us. He built himself a monument, more durable than one of bronze or stone, in our hearts. We wish him Heaven's richest blessing for the remaining years of his rich and fruitful life. May the years of his retirement bring him happiness and peace!

---

# The Students' Message to Dean Monin

IT is enough for man to work, to hope, and to love. But, greatest of these is to love.

A college curriculum is designed primarily to teach students how to work. The college environment is created and fostered to inspire ideals, to familiarize the student with aspirations attained, and to encourage thereby the quality of hope. As for love or charity, its presence in a person's character is essentially and exclusively a result of personal reaction to another's individuality. A college which is able to aid the development of this element in the lives of its students performs a distinguished service to society.

In the past four years of our work at Armour Institute of Technology, we students who are now graduating have come in contact with an outstanding personality in Dean Monin. In our freshman and sophomore years, an admittedly difficult period, we felt the influence of his kindly guidance. In our junior year we had our first really personal contact with him. His economics lectures were a source of pleasure because of their intensely human character. It was here that we received in more ways than one a lasting impression as to what constitutes the fundamental basis of life's values. Finally, in our senior year he opened before us new vistas of thought. Philosophy became a delight, and through it we came to know our dean as we had always wanted to know him, and what is more, as we believe he wants us to know him.

Our happy associations together have come to an end. We, as graduates, are leaving the Institute where Dean Monin's life work was done. Dean Monin has already retired from the activities of his professional life.

Dear Dean Monin, to know thee is to love thee. We have come to know you very well. We regret that you have gone back to the scenes of your youth in that it means that we cannot renew our associations. But we are happy that we have had the privilege of spending four years with you. It is our sincere and heartfelt wish that you may enjoy the fruits of your splendid life in years of health and happiness. Remember that you have a place in our hearts which none other will fill. Because of our individual response to your life, the Institute has rendered a distinguished service to society.

# An Alumnus Says Farewell

ALL alumni and former students of Armour Tech have learned of Dean Monin's retirement with mingled feelings of regret and satisfaction. Regret that so engaging and colorful a personality will be lost to us and to A. I. T.; satisfaction for him that he may now lay aside the duties of an exacting office and enjoy, while there is yet time, a well-earned rest.

From the very beginning of the Institute we, his former students, generation after generation, have sat in his classes and learned things never mentioned in the curriculum. From other professors we learned the fundamentals of our profession; they taught us how to succeed at engineering, but Dean Monin taught us how to succeed at living. He was called Professor of Philosophy, but it would be greatly to underestimate his talents to call him a teacher of philosophy. He was rather a teacher of young men by means of philosophy, and what a splendidly human, Moninized philosophy it was.

Our program cards, couched in the exact language of the curriculum, called for psychology or philosophy or logic, but it would have been more accurate if we had simply written *Dean Monin* in the little rectangular space on the card. In the physics laboratory we saw the prism unbraid the light and present it to us in all its rainbow splendor. So in Dean Monin's lecture room, we saw philosophy strained through the luminous screen of his personality and held before us in all its essential beauty. So those subjects on which the Dean lectured and which the student of engineering sometimes considers with misgiving lost all their imagined terrors. Much learning was reduced to just a little wisdom, applicable to life as it is lived. We learned to worry less and smile more often, to strive a little harder, to live a bit more worthily.

It is for the personality which Doctor Monin projected into and through his teaching that all his students remember him with so much affection. From no yellowing leaves in some dusty tome were his lectures taken; they came from the living pages of his own life and experience. Out of wide understanding and deep sympathy he talked to his "boys," as he often called us, and we in turn realized that here was no uninspired relayer of canned information. In him there was little of the pedagogue, none of the preacher, and much of the *pater*.

Like the thematic variations in a musical composition, there ran at all times through his classroom utterances a broad and kindly tolerance, the logical outcome, it seemed to us, of his serene and friendly spirit. He felt no urge to *make* his world better; he was satisfied if he could help it to become a little wiser and a little happier.

And now after thirty-four years of distinguished service as an architect of character he has retired and gone back to his native Switzerland. Perhaps after a year or two he will come back to pay us all a visit; for some of us a long-anticipated trip to Europe may afford an opportunity for a visit to our inspiring and well-loved teacher. And so we won't say good-bye, but just a cheery *auf Wiedershen*, while we express hope that his leisure years, so richly deserved, may be blessed with a generous measure of health and happiness. May his career be crowned with the joy and satisfaction which come from duty well performed, friendships many and lasting, memories that time cannot tarnish.

## A MESSAGE FROM OUR NEW YORK ALUMNI

IN a letter to President Raymond, R. M. Henderson, '02, tells of the farewell banquet tendered Dean Monin by the New York alumni. He says, in part—

"It would have done your heart good to have been here Friday evening to witness something that probably was a revelation alike to Dr. Monin and us of the New York alumni. Our numbers here are smaller so that when thirty men out of the fifty-two alumni who are living in New York and nearby were gathered at the Lotos club, Friday evening, there was an intimacy that could hardly characterize the larger gatherings that you have in Chicago.

"Dr. Monin, as I recall it, never had roll call in his classes but we had one, each man rising to address Dr. Monin in his own way to express, often in stumbling words but always with a sincerity that had us choking at times, grateful remembrance and recognition of the fact that their lives had been enriched and broadened by the Dean's teachings and character as they have been by no one else under whose influence they have come.

"These talks had been preceded by the presentation to Dr. Monin by Mr. White, the master of ceremonies, of a sterling silver pitcher. The inscription on the pitcher was, in White's language:

'The pitcher returns to the well'
to
Dr. Louis Celestin Monin
With grateful regards from
Them that are refreshed
Bon Voyage
at New York
April 29th, 1927.

"You can hardly imagine a more impressive moment. The Doctor was completely overcome. He was on his feet, eyes filled with tears and a lump in his throat that choked his attempt to speak. I noticed some others were about as badly off. Mr. White continued to talk for a minute to give the Doctor a chance to recover himself and diverted his thought from his emotions by asking him to tell us something of his Switzerland. Then for nearly thirty minutes we listened to Dr. Monin in such a fine vein of humor, pathos, philosophy, optimism, and grateful appreciations as would have delighted all who have ever known him.

"Visualize, if you can, a beautiful room with walls covered by life size portraits of some of this country's greatest men, an immense square table almost filling the room with eight men on each of the four sides, the whole table covered with flowers, apple blossoms, and a carpet of ferns over a spotless white cloth. The Doctor in a big comfortable chair at the center of one side and the rest of us, from the class of '97 to the class of '18, grouped around naturally in congenial twos and threes. The Doctor's face was a study as he looked about him.

"All too seldom is a man permitted to hear from the lips of his friends such tributes as were paid to the Doctor that night. We are more than glad that we had the privilege of spending with him his last evening before he began his well earned season of rest, recreation, and quiet contemplation of a life which, measured by the highest standards by which men measure success, has been a successful life of the first order.

"The Institute has lost something that I doubt will ever be replaced. We who have had the high privilege of his association and guidance into a realm exalted and filled with inspiration feel that future generations at Armour are going to miss something which has been the soul of the Institution."

# *Building to Reduce Fire Losses*

By C. K. STIFF

*Assistant Engineer, Inspection Department, Associated Factory Mutual Fire Insurance Companies*

*Courtesy of Associated Factory Mutual Fire Insurance Companies*

SPALLING OF CEILING AND COLUMNS

The severe [illegible] in this section burned away the wooden forms and spalled the concrete until the reinforcing rods in the ceiling were exposed. The débris from the fire had been cleaned away and the new partition and supports installed before this picture was taken.

MOST industrial officials appreciate the superiority of a plant safe from possible interruption by fire. Serious fires mean loss of profits, skilled employees, and customers. Full insurance, even including the use and occupancy type, will not reimburse a prosperous progressive concern for the setback incurred. Less thoughtful managements are induced to good construction and adequate protection by savings in insurance, a more tangible but usually less important factor. Just which features require attention and their relative importance, however, are often not clearly understood by owners and architects. Unnecessary expenditures may be made or important points slighted.

Construction and protection are in a large measure dependent on each other for effectiveness in resisting fire. Good construction embodying fire-resistive building with limited fire areas and segregation of hazardous processes has repeatedly proven its worth in shutting out or confining dangerous fires. No attempt is made in this article to discuss the protective equipment required for industrial buildings. Almost without exception, however, a standard sprinkler system, supplemented by yard hydrants, if necessary, should be installed. These systems are the best protection against fire known and have been more responsible than any other factor for the great reduction in industrial fire losses during the last thirty years.

A well arranged plant will have values in buildings and in stock reasonably subdivided and hazardous processes separated from main manufacturing rooms. These features are essential and should not be overlooked or slighted. With study, a satisfactory arrangement which will not interfere with production can nearly always be worked out.

A plant effectively divided by adequate separation of the buildings, or by substantial fire walls, would rarely be entirely destroyed by fire, even with complete failure of fire fighting equipment. Many fires have defied able efforts at extinguishment only to burn themselves out at fire walls, laying waste only one building or group. The advantage of proper division of a plant, however, is often not appreciated. Small additions repeatedly built may materially increase the size of building units and give a poorly arranged plant. In time of rapid expansion, needed fire cut-offs may be ignored. The situation is then difficult and expensive to correct. Excessively large floor areas should also be avoided, if possible, as they allow wider and more rapid spread of a fire and greater water damage from sprinklers or hose stream. Heat waves in a large room may open sufficient sprinklers to severely tax the water supplies. In long foundry type buildings with pitched roofs, fire curtains or baffles are often placed across the roof at intervals to prevent this.

Collapse of unprotected steel-work. The failure of the interior columns in the background pulled down the side walls.

Valuable stock of any nature should not be kept in manufacturing rooms subject to the fire hazards of manufacturing processes and liable to much smoke or water damage. Valuable finished goods, usually needed to fill current orders, warrant the protection of a separate fire resistive or slow burning warehouse, provided with water-tight floors and adequate floor drains or scuppers. Smoke or water will easily damage

such materials as textiles, paper goods, unpainted metal products, or food stuffs.

Certain manufacturing tools such as dies, gauges, and jigs may be difficult and expensive to replace. Vaults should be provided for this equipment. Foundry patterns rapidly accumulate, representing large values. Special pattern storehouses are needed to accommodate this storage.

Ruins of a fire which threatened to assume conflagration proportions. Further spread was checked by the superior construction of the American Building.

Storehouses are also advisable for any considerable amount of raw stock of high value, and essential for production. Storehouses should be divided into units of limited area by substantial fire walls. This is especially true of buildings storing baled cotton, jute, and other fibres, as fires in these materials are difficult to fight and extinguish.

Separate buildings, or separate sections of a plant which may adjoin main buildings, if well cut off from them, are usually required to house particularly hazardous installations or large departments where the work is of such a nature that fires are prevalent or unusually severe. Small departments of moderate hazard can usually be enclosed by fire resistive partitions, the floors of these rooms being water-proofed and drained if necessary. Insurance companies have spent much time studying industrial hazards and are always ready to assist in safeguarding hazardous processes.

Cheap, hastily erected, buildings may seem desirable for temporary use. These buildings, however, very frequently become necessary, permanently, but are then recognized as quite unsuitable for their work. A little more expenditure to secure a better grade of building more suitable and also more adaptable to various uses would have been economical. Too long delay in building needed warehouses or extensions may cause serious congestion, and a fire hazard, as well as reduced efficiency in production.

WHEN the layout of a new factory or addition has been planned, the owner and his engineer or architect must choose the type of construction to be used. The common types of factory buildings are reinforced concrete, either of the beam and girder or flat slab design, steel frame buildings with steel either protected or exposed, slow-burning or *mill* construction with brick bearing walls and heavy timber interiors, *semi-mill* construction a modification of the standard mill type with smaller timbers, brick buildings with joisted interiors, and wood frame buildings.

Concrete and brick are the most fire-resistive of the common structural materials. When concrete is exposed to fire, a considerable water content must be evaporated before calcination is completed. The calcined surface then serves as a good insulation for material below. A very important detail is the choice of coarse aggregate. Siliceous gravels should be avoided, if practicable, as such stone will disintegrate severely under fire exposure, producing very badly spalled or pitted surfaces, and exposing the steel reinforcement. If for any reason, sprinklers will not be provided, careful choice of aggregate is especially advisable. Limestone is the best aggregate. Trap rock and clean cinders are very superior to quartz gravel. Reinforcing steel should be held properly in position to receive sufficient protective covering. Expansion of a floor or floors subjected to a very severe fire may cause shearing of the columns. Where considerable amounts of combustible material are present, sprinklers will protect the building itself as well as its contents. Sprinkler systems can be economically provided with flat slab ceilings. Flat slab construction is less damaged by fire than the beam and girder type as the surfaces are in general smooth without corners, which would spall badly. The floors of concrete buildings are more or less water-tight, depending upon the care and experience of the builder. Water-tight floors are in many ways a definite asset to any plant and builders could well give more attention and study to this feature.

Fire resistance of concrete, heavy timber construction, and partition tile in an unsprinklered building. The fire resistance of the above tile is inferior to that of load-bearing tile.

Steel frame industrial buildings seldom have all steel work protected except where the local building code requires such construction. A fully protected steel frame with non-combustible floors and roof approaches a concrete building in fire resistance. In buildings of this type, which are usually many stories in height, water-proof floors are especially desirable, and in the case of storage buildings, essential. Porous cinder concrete floors, without water-proofing, have allowed large water damage.

Slow-burning or mill construction has had an excellent record, when under reliable sprinkler protection. The wide smooth surfaces of beams and floors char under a hot fire, but do not burn rapidly. The depth of charring often is not sufficient to affect the strength of the floors. Deprived of sprinkler protection or subjected to a severe fire, however, such buildings can be badly gutted and seriously damaged. The ends of floor beams should be adequately supported. Column caps with brackets for the beams if used should be of cast or heavy pressed steel or malleable iron and of substantial design. An arrangement with small cast iron pintles to carry the load from the columns above to those below will permit the ends of the beams to bear over the columns themselves. Floor beams should also be self-releasing at the wall to avoid pulling down the walls, in case of a failure of a floor. Beam hangers, if used, should be of substantial construction.

Great care should be taken in the selection of structural timber to avoid wood infected with dry rot fungus. In-

spection of lumber and purchase from a mill or yard which is not infected are important. Dense resinous stock should be selected. Lumber should not be used in contact with the ground and should be erected so that natural drying out and ventilation is possible. When used where conditions are favorable for dry rot development, such as weave sheds running high humidity, treatment is advisable. Creosote or sodium fluoride treatments are commonly used. Sodium fluoride has certain distinct advantages. When treatment is given, the cheaper grades of wood are used in place of expensive dense resinous stock.

The demand for longer spans and the scarcity of reliable timber have led to the substitution either of steel beams, or semi-mill construction for the standard type. Semi-mill construction is better than the joisted type but the timbers are so much smaller in cross-sectional area than in the standard mill construction that the same charring will reduce their strength much more. The pockets produced in the ceiling require additional sprinklers. A greater proportion of the floor area is dependent upon beam hangers for support.

Exposed steel work is susceptible to damage by fire. The heat furnished by the burning of a surprisingly small amount of combustible material present either in the building itself, or its contents, can do great injury. The burning of wooden roof decks, supported on steel trusses and purlins, has repeatedly wrecked buildings. Failure to heed the decisive evidence of the past decade in this regard, is constantly swelling the country's fire loss. Steel is a very useful building material, however, and fortunately is reasonably protected by the discharge from the automatic sprinklers required in most cases to protect the occupancy. The sprinklers cool the steel frame and extinguish the fire.

In multi-story buildings, however, where the loss from possible collapse would be great, entire reliance cannot be placed on a protective system which might be inoperative. The steel work in this case, is also carrying heavier and more important loads. In buildings with combustible occupancy, fire proofing of all columns supporting floors, or girders supporting columns, with at least 2 inches of concrete or the equivalent, and cross girders supporting floor beams, with 1 inch of cement plaster on metal lath is advisable. For ordinary occupancies, floor beams may be considered as reasonably protected by the sprinkler system, as in the case of steel beams in mill construction. In hazardous occupancies, or where large quantities of combustible material are present, the cooling effect of sprinkler water may, however, be insufficient to protect the steel.

Joisted and wood frame construction should be avoided in industrial building. The small saving in first cost is false economy. Even for a temporary building, the advisability of such construction is questionable. The small joists or studs and the light floor systems are excellent kindling for a fire. To improve the appearance of walls and ceilings they are often sheathed. This practice creates objectionable concealed spaces, through which fire can rapidly spread, beyond reach of sprinklers or hose streams. Unless properly fire-stopped, frame walls are a flue from basement to roof. Complete distribution of water from sprinklers on a joisted ceiling is impracticable. To provide reasonable protection, more sprinkler heads are needed than with any other type of construction. Fires in joisted floors follow the spaces between joists and are often difficult to reach with hose streams from one direction.

Although surrounding buildings were completely destroyed, the wired glass in a steel sash backed by a tin clad shutter so well protected this interior that the sprinkler did not open.

CERTAIN details of construction, notably fire walls and fire resistive partitions, fire doors, stair and elevator enclosures, water-tight floors, and cornices, deserve particular attention.

During the past few years, valuable tests have been made by responsible parties to determine the fire resistance of various kinds of walls. The probable intensity of fires with various typical occupancies is now being investigated to permit applying quantitatively these test results to actual conditions in the field. Present knowledge and experience indicates that walls serving as major divisions of a plant, or as fire walls in storehouses, manufacturing, or other buildings containing large quantities of combustible material, or exterior walls facing very severe exposure, should have a minimum thickness of 12 inches of solid brick, 19 inches of reinforced concrete, or 16 inches of load bearing tile. For fire walls in low one-story buildings, for curtain walls sub-dividing large areas in fire-resistive buildings containing moderate quantities of combustible material, or for cutting off particularly hazardous or valuable occupancies, a minimum thickness of 12 inches of load bearing tile, 8 inches of solid brick, 6 inches of reinforced concrete, or 8 inches of cement block should be used. For enclosures about vertical openings in fire-resistive buildings at least 8 inches of brick, tile or concrete block, or 6 inches of reinforced concrete should be used. Greater wall thicknesses may be required by load bearing considerations or for structural stability at ordinary temperatures, according to good engineering practice. Two inches of cement plaster on metal lath, supported by a steel frame, makes a strong and fire-resistive partition. Gypsum block of proper thickness may also be used for partitions.

To maintain the desired fire-resistance with the minimum wall thicknesses, combustible members should not project into walls more than 4 inches. The distance between the ends of members framing in from opposite sides of the wall should also not be less than 4 inches. Tile and concrete block should have at least 4 inches of solid material as filling above and below combustible members. Brick, tile, and concrete block walls should be laid with cement mortar tempered with not more than 15 per cent lime. Gypsum walls should be laid with gypsum mortar. Plastering of walls will materially increase their value. Cement or gypsum plasters, however, should be used, as lime plaster rapidly spalls off under fire exposure.

The behavior of the various materials under fire and water exposure, as observed in fire tests, is instructive. As mentioned previously, concrete spalls more or less, depending on the nature of the aggregate. Thick masses become unequally heated, producing temperature strains which may cause fracture. Brick

(Continued on page 152)

# THE STATUS OF THE ILLINOIS WATERWAY

**By MURRAY BLANCHARD**

***Hydraulic Engineer, State of Illinois, Division of Waterways***

IN 1908 the people of Illinois voted an amendment to the State Constitution authorizing the construction of The Illinois Waterway and for a bond issue of $20,000,000 to cover the cost.

During the period of some ten years following the authorization, various inadequate plans were proposed. An insufficient waterway law was enacted in 1915 and an application was made to the Secretary of War for a permit and refused. The State legislature appropriated $5,000,000 for the construction, and locks 55 feet by 250 feet were contemplated. Efforts were renewed in 1917 and new studies and surveys were made. The legislature in 1919 passed a waterway act in conformity with revised plans. Again in 1919 application was made to the Chief of Engineers and the Secretary of War and a permit was issued on January 6, 1920, authorizing the construction. The permit was slightly revised March 6, 1920.

The Illinois Waterway is that portion of the Lakes to the Gulf Waterway from the lower end of the Sanitary District's main channel at Lockport to Starved Rock, which is 6 miles above the head of steamboat navigation of the Illinois River. In this stretch there is a total fall of 139 feet. The project calls for the improvement of the Illinois and Des Plaines Rivers between these points so as to make navigation possible by the construction of locks and dams.

From Lake Michigan to Lockport, the Sanitary District channel is over 20 feet deep and 150 to 200 feet wide. Below Utica the improvement of the river is under the jurisdiction of the United States Government.

It is contemplated to eventually take advantage of the potential energy available and develop water power at each of the dams. This development cannot be worked out in detail until a definite authorization is made of the amount of water that can be withdrawn from Lake Michigan.

Considerable progress has been made on the construction of the Waterway. A lock at Marseilles has been built. The first contract was let on October 26, 1920. Work was commenced on November 6, 1920, and the concrete construction was completed and accepted on August 20, 1923. None of the steel work on this lock has been installed.

At Lockport the contract for the concrete work was let on October 8, 1923. This construction was recently completed. At this point the valves, lift gates, and emergency dam are installed, and the other steel work is fabricated.

At Starved Rock the first bids were opened in November, 1920 and were all rejected as being too high. Litigation ensued, and progress was delayed for many months. A test case was brought in the LaSalle County Court concerning condemnation of the necessary lands that would be required in the area to be flooded. This case was decided against the State. Appeal was made, and a favorable decision was rendered in the State Supreme Court enabling construction work to proceed.

*Photo—Courtesy of State of Illinois, Division of Waterways*

Marseilles lock of The Illinois Waterway. Length, 938 feet; width, 110 feet; lift, 28 feet.

The Starved Rock contract was readvertised, and the contract let in 1926. The excavation is about 50 per cent completed and the concrete construction has been started on the footings and side walls. The locks are 600 feet long and 110 feet wide with a depth of 14 feet on the miter sills. This will enable fleets of 9,000 tons such as operate on the Ohio and Mississippi Rivers to lock through without breaking up the fleets.

At Marseilles there is a dam across the river, which will be utilized by raising its crest. At other sites, dams will be constructed across the river provided with taintor gates for regulating the water level and a special section at one end constructed as an ice chute.

The capacity of the Waterway is estimated at 60,000,000 tons. Such a traffic would call for 1500 c.f.s. of water for lockage purposes in the summit pool which is above Lockport.

As the only economical and feasible way of obtaining water for this upper pool is by the withdrawal of a supply from Lake Michigan, the State is vitally interested in the suit now being heard before Special Master Charles E. Hughes in the Supreme Court of the United States.

The states of Wisconsin, Michigan, Ohio, Minnesota, Pennsylvania, and New York are suing to prevent the withdrawal of any water or of an adequate amount of water from Lake Michigan by The Sanitary District of Chicago. The State of Illinois and several Mississippi valley states have become parties in the defense.

In this case some interesting features were brought out. Only one of the complaining states sues for no diversion from Lake Michigan, claiming that a supply for the summit level could be obtained from the Des Plaines or Kankakee Rivers, or by pumping water from a lower level at the mouth of the Fox River. These schemes were all deemed impractical by the defendants as the cost of the operations would be prohibitive, and require such tolls that commerce would be discouraged as unprofitable. Abandonment of the project would be recommended and the millions of dollars already expended would be a total loss to the state.

The Lake Carriers Association claims that shipping on the Great Lakes is damaged by the lowering of water levels due to the withdrawal of water at Chicago. It is generally agreed that the effect of such withdrawal is to lower water level approximately 6 inches. It was brought out in the suit that excavations of gravel from the bed of the St. Clair River for commercial purposes have increased the sections at the outlet of Lake Huron to such an extent that the level of Lake Huron is lowered about 4 inches. It is proposed by the defense that the effect of lowering from all causes can be overcome by regulating and compensating works, and thereby, a higher and steadier

*(Continued on page 138)*

# BUSINESS AND THE ENGINEER

**By LOUIS C. THOELECKE, '24**

***Nebraska State Agent, National Security Fire Insurance Company***

ENGINEERS graciously accept the compliment bestowed when philologists declare that the *gin* of *engineer* and the *gen* of *genesis* are derived from the same root, meaning *to create*. That essential quality of the true engineer is not widely appreciated, but it is generally conceded that the chief responsibility of this failure can be placed at the feet of the engineering profession. Almost invariably the materialistic benefits accruing to the good of mankind can be attributed to the work of an engineer, but the engineering profession sits idly by and permits the public at large to graduate him to the class known as inventors, wizards, or capitalists.

Among the graduates of engineering colleges, there is an unmistakable bond, built, principally, upon the realization that the other fellow, because he has accomplished successfully the work leading to his degree, commands admiration and respect. And, why not? It is usually conceded that the engineering course is a "stiff" course, but not until the recent survey and thorough investigation of the Society for the Promotion of Engineering Education have the facts been a matter of record.

It has been definitely established that the average student entering an engineering course is considerably above the general average of students entering college. They have been classed as *superior*—sixty per cent of them coming from the highest third of their high school graduating class, and only two and six-tenths per cent coming from the lowest third. That, in itself, is commendable. But let us go further! At the end of the first year, only sixty-two per cent of the entering students remain in the engineering college. At the end of the second year, forty-two per cent of the students remain; and only thirty-seven and five-tenths per cent of the students entering engineering courses ever graduate.

By comparison, the corresponding percentage in colleges of medicine is seventy-five per cent, law sixty per cent, dentistry sixty per cent. Considering the quality of the entering engineering students, it is apparent that the graduates have overcome difficulties of significant magnitude during their college career. Is it not, therefore, quite conceivable that something in common should exist between men who have received their degree in engineering?

To the one remaining in the purely technical channels after graduation, the value of an engineering education is a foregone conclusion. It is as essential as the study of law is to the lawyer, or medicine to the doctor.

On the other hand, there have been lengthy and somewhat heated discussions as to the relative value of an engineering education to the man who, by choice or by unexpected press of circumstances, finds himself in a position combining application of engineering knowledge with sales production methods or executive responsibilities. The recent active work of the Society for the Promotion of Engineering Education has provided an impetus for new activity along this line, and has brought to light some very interesting and encouraging viewpoints.

> *"Among the graduates of engineering colleges, there is an unmistakable bond, built, principally, upon the realization that the other fellow, because he has accomplished successfully the work leading to his degree, commands admiration and respect.*
>
> *"It has been definitely established that the average student entering an engineering course is considerably above the general average of students entering college. They have been classed as 'superior'—sixty per cent of them coming from the highest third of their high school graduating class and only two and six-tenths per cent coming from the lowest third."*

Not long ago, a meeting of the four major engineering societies was called in one of our larger cities, at which time a representative number of prominent industrial and business leaders—engineers, if you please—who, for business reasons, had been obliged to assume such titles as President, General Manager, or Chairman of the Board, stated, without any previous collusion on their part, that it was their firm belief that the present concern with respect to the engineer's ability to fill executive positions was largely overdone. Notwithstanding the fact that a large number of engineers do not bend their efforts toward the attainment of high executive positions, there was common feeling that, in proportion to their number, there are as many engineers in the chairs of high executives as any of the other avocations or professions that enter the realm of industry. They agreed that it is largely an individual matter and that some who, undoubtedly, possess natural executive ability do not wish to cultivate it and, further, it is a reasonable assumption that some who cultivate this natural ability do not have an opportunity to use it.

One outstanding danger was recognized. Too biased and untempered allegiance to the purely materialistic and technical phases of the profession is to be avoided, except possibly for the man who, in seclusion, hopes to develop and create the things which will classify him as one of the selected few, a genius. Most certainly the work of the genius commands our profound respect and admiration. It is indispensable, highly commendable, and constitutes the foundation on which we must build but, generally speaking, the degree of his service to mankind rests with the agencies which must interest and adapt his works to the things for which they are best fitted and most needed, and which, not infrequently, can only distantly be connected with the inspiration and urge which contributed chiefly to their creation.

Economic situations change, and great losses must be born by mankind if the *contact* engineer fails to get his cue. That great composite known as the public is at once most tolerant and most exacting, most stupid and most critical, and upon the shoulders of these contact engineers rests the responsibility of properly and effectively supporting certain action which will accrue to the benefit of their fellow men. Throughout the world there is a great army of these contact engineers, engineer-executives, engineer-capitalists, engineers in numerous walks of life, bearing titles and filling positions which may, in no manner, reflect the nature of their work.

There is a propensity, as a result of close association with the subject, to illustrate by reference to the particular field of endeavor in which one is engaged. So, we recall that, less than three years ago, amid some expressions of timidity as to the advisability of such action, the annual caucus of the National Fire Protection Association indicated their belief in the necessity of a contact engineer by the employment of a field engineer for the Association. In this manner, the result of years of study of fire prevention measures could be communicated to the general public through the interested organizations and individuals of various

*(Continued on page 154)*

# A LETTER TO YOU FROM EUROPE

*By* WALTER HENDRICKS

*Assistant Professor of English*

Sun Hill Lodge,
South Godstone, Surrey,
England.

April 5, 1927.

Men of Armour:

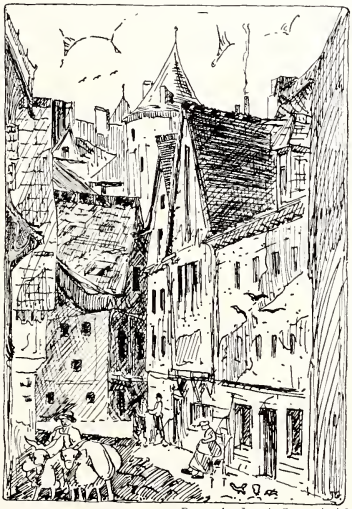
As many of you will, or may, or should remember, I have repeatedly and repeatedly told you that you should shoot your skyrockets at the beginning and at the end of your compositions and save some sleep-dispelling canon-cracker for some point about half-way between.

And now to prove to you that I practise what I preach and believe what I say, at least, in this respect, I shall first tell you that we (my wife and I) crossed the ocean in steerage, for the sake of an experience.

But we made two mistakes: we took passage on the largest steamship afloat, and we tried an outward instead of an inward voyage. And perhaps we were twenty to fifty years too late, for the days of "steerage" are past, if, from our own experiences, we are to judge the stories of many of our friends and acquaintances who came over that way. *They* tossed all night on hay in bunks open to view; *we* rested comfortably on clean cots in well-kept cabins. *They* had to wash their own dishes in the hot water from the potatoes; *we* rose from our seats as if we were dining at the Drake. *We* had baths, at our own appointed time; we had games, on deck and in the lounging room; we could sit and read books from the ship's library, or listen to New York or London orchestras over the radio.

We knew at once that all had changed; yet, we did not lose everything, for human nature does not change as rapidly as fickleminded custom. Here, still, was humanity up the river almost to the huge granite blocks from which these rough slabs had been broken. They had not yet felt the rounding and the smoothing action of the stream of social intercourse. But for all that, there was something fine about them as there is about those rough, unpolished stones.

But they were not all of the shawl-covered type. On the contrary, some were very polished; there was the diamond merchant who had made forty-two trips across, to whom the pitch and roll of the ship were no more than the swaying of a railroad train. He was almost brutally immune to those poor people who were always sucking citrons. And the jolly part of it all was that he was an atheist. Now, with a long-haired religious fanatic, who had been in America for a year working in the Ford plant, and who sat reading his Bible all day long; and with a man named Lazareff, whom I shall describe later; and with your humble servant, you may be sure we had some very picturesque talking on religious and philosophic themes. The poor man! He had held in his hands thousands of costly gems; but he had never sought for the pearl of great price. His god was gold.



*Drawn by Joseph Grosguth, '28*
A street in Madrid

Mr. Lazareff was a very different man. He had come from the Old Russian nobility; he had lived a life of ease and luxury; he had held governmental portfolio. Then came the Russian Revolution when he was forced to give up everything. And then follows a long story that brings him to America. And now, he, a Jew, is returning to Russia to teach the common people the principles of the brotherhood of man. He was not a radical, unless you would call a man who believes in this teaching a radical. He was quite sane. He really knew what he was doing. And I admired him, a young man over fifty, who talked with the fire and vision of one of you men. And I shall never forget the nights on that infinite sea, a path of it like quick-silver leading to the moon that was sailing along at full, nights on that tiny chip that had seemed so huge to us when first we saw it roped and cabled to a dock, as we paced, arm in arm, the salt-sprayed deck.

There were others. I shall tell you later about Martinelli. And there was another Italian who wore a new pair of bright blue overalls, who had been disappointed in love, but who was going back to his native land to marry, and to bring back, a woman he had never seen, a sister of a friend to whom he had told his sad story, who, on hearing it, had asked, "Why don't you marry my sister?" —with this result. He would tell this naive story to anyone who would listen, and produce seven affidavits stating that he was, absolutely and unqualifiedly, a single man.

After disembarking at Cherbourg and stopping to view that wonder-city, Paris, we moved on at once to the so-called castle country of Spain. We had planned to spend the winter there but we were fortunate to escape with our lives at the end of a month's suffering. Castles and cathedrals? Plenty of them. Marvellous things. We visited them everywhere. We went down into their vaults and saw treasures that took away our breath, that dazzled our common eyes, that nearly overwhelmed us with their costliness. We visited the Escorial and stood in the room where lie the bones of the dead rulers of Spain. We marvelled at the things we saw. But nowhere have we seen such pitiful beg-

gary, nowhere human beings so miserable and wretched. I don't suppose there were many shovelfuls of garbage on the streets of the very capital that were not pawed over by some child's hand. There were beggars everywhere; vermin of all kinds in almost every dwelling.

We went time and again to the "Del Prado," feasted our eyes upon the paintings of Velasquez, of El Greco, of Goya; we visited the school Loyola and Cervantes attended, in Alcala; the home of El Greco and a lodging place of Cervantes, in Toledo, where there are, also, a magnificent cathedral and Moorish mosques dating from the Middle Ages. But back of it all, the extreme poverty and the sordidness.

Sunny Spain? Yes. The sun shines in a deep-blue, cloudless sky. But it parches everything so fiercely, and reveals the filth so starkly, that one almost prays for clouds to come and conceal it. In the middle of the day, from twelve to four, life seems to cease, shops close, people go in-doors and hide from the sun. And they must sleep then, for all night long there is an unholy and a frightful din that steals away sleep from any who are honestly weary.

"There are waste stretches where there is not a sign of vegetation and there are other stretches where only the olive and the turpentine trees grow."

Outside our window, at two o'clock one morning, several women began beating their carpets. I cried out in my best Castilian, "Cease. Desist." But to my chagrin, being sensitive about my linguistic ability, they seemed not to understand. In my fit of anguish, I seized upon something more substantial, a pitcher of that precious stuff called *agua,* and hurled all but the pitcher in their general direction. They simply eyed me standing in my pajamas, in the moonlight, on a Spanish balcony; decided I was a lunatic; and turned again to their slam-banging. When I saw what was happening, I became even more furious, this time hurling down the keenest-edged expressions in American English that I could think of, such as "Go to bed: don't you know anything?" Even this bitter sarcasm had no effect; so, at 2:30 A. M., utterly disgusted with Spain and all things Spanish, I went back to bed and covered up my head, though the temperature in the moonlight was exactly 212 degrees.

Of course, you will wonder about the bull-fights. Yes, we went also to one of those spectacles. But they aren't designed for Anglo-Saxon eyes or hearts. And they are misnamed, for they are not fights; they are an inhuman slaughter of dumb animals. Nothing in my life has ever pained me so much as that sight. The bull enters the arena and, seeing the crowd of people, stands pitifully amazed. Then he espies afar off, the form of a man who is waving a red cloth which attracts him and lures him on. In fact, he charges at the cloth, only to feel the sharp point of a sword which the human scoundrel has held concealed in the cloth. He charges again, and again receives a sword thrust. Soon he becomes furious from these cuts, because he has begun to bleed. And now the real show commences. In rides a gaudily dressed inhuman being on horseback who continues this persecution, breaking spears and barbed blades in the bull's back. The bull, of course, ignorantly charges the red cloth which the brave men in the arena wave safely at their side, unless they have driven in a blindfolded horse to be gored and thrown up into the air. Finally, the bull, from loss of blood, can charge no more and sinks to the ground. Yet, still the human brutes will not kill the bleeding beast, but continue to wave their red cloths in front of his eyes, trying to get him to rise once more. And it is only when he cannot rise again or when he rises only to collapse, that one of these inhuman beings thrusts a dagger into his head to end his misery.

We left after we had seen two bulls slaughtered in this manner. There were many more to be played with for the pleasure of so-called human beings, but this was all we could endure. And then to think that this spectacle is repeated twice or thrice each week during the season in practically all the important cities in Spain! Is it any wonder one finds ruin there? Of course, there must be many who hate it. But what can they do? They have little political freedom and practically no religious freedom.

I traversed the length and breadth of Madrid, rambled down hundreds of their narrow streets with their houses in a solid mass, spent hours in the market-places, and even followed the funeral processions of men, who always buried the dead, walking the many miles to their awful cemeteries and standing at the gaping graves while a few male mourners stooped to lift a cover-chief and coldly kiss a blackening corpse.

The countryside is pitifully barren, the mountains practically nude. There are waste stretches where there is not a sign of vegetation and there are other stretches where only the olive and the turpentine trees grow. Still, I have walked out over those desert lands and seen little pale blue flowers springing up out of the sand.

The efforts to gather water are sometimes really touching. When our train stops at a station, girls come out with huge jugs to catch the boiling water from the engine. And along the way, one will see at rare intervals in the revolving landscape, small patches of potatoes that are kept green by water that is pumped from a well by a blindfolded ass that walks around and around.

We came away, as I have said, in about a month, and just before a seige of typhoid set in. And going and coming, we had to submit to surveillance by soldiers who rode in every train and to questioning by the secret agents of the government.

We returned to France in time to see the close of summer, and settled in a quaint old town, in a farming community among the hills. Here we found those humble scenes that Millet and Dupré took pleasure and pride in painting, and throughout the country a kind of combination house and barn that must have been the forerunner of the rambling type of farmhouse of New England.

We shared with the family of a French general, a villa that had been built so long ago that the stone steps of the staircase had become worn thin. The name of it *Villa des Souvenirs,* seemed

almost ironic, since the old white-haired general had come here to forget the war he had lived through and to forget the loss of his sons. But any villa would have been for him, as for millions of others, a villa of frightful memories.

Later, I attended the University of Grenoble, where the courses were nearly all of the lecture type, courses for "stuffing the goose with chestnuts," requiring only an occasional exercise and a final examination. Education seemed to be more a ritual than an adventure, more a matter of receive and return than of give and take.

"The Arc de Triomphe under which a torch flares vividly in the wind. Every hour of the day, hundreds of men pass this light, and every man lifts his hat."

Our villa in Grenoble was situated on the side of a hill; and for our view we had the valley of the Isére, and beyond, the Belladonna Range of the French Alps. Into the hills and the mountains we made many delightful excursions, also down into the unfrequented places around us. We often found ourselves so curious as to watch a baker turning out loaves that looked like cart wheels or life-preservers, that men would sling over an arm and on their shoulder with unconcern, and go walking or riding down the street; or to study the maker of wooden shoes carving out sabots, that men and women and children everywhere, wore without even taking thought that they were made of wood and not of leather, and with a grace, too, even though to us they clomped clumsily.

Everywhere men and women drank wine freely, going into the neat and trim cafés after market, and settling with a friend over a pitcher of red or white, brought to them by a kind, motherly woman or her daughter. Everybody seemed to drink, but not once did we see (or hear) a drunken man.

Their politeness and friendliness had a ring about it that sounded genuine. One always talked to one's neighbors, on the tram or train, and one never thought of going into a shop to buy anything without first enquiring about the baby and then standing to listen to an account of the health and failures or successes of each member of the family. Finally one is waited upon (and given good measure, too), then one goes out, thinking not how much time one has wasted but how kind people really are.

Prices are very favorable for the American. I know I shall squirm when I return and have to pay 75 cents for a haircut and think of those works of art I had performed on me for 10 or 15 cents. And can I ever forget the haircut, shave, shampoo, half-pint of eau de Cologne, and mustache! trim for 38 cents? Never! Room and excellent French cooking, 90 cents a day! Third class railroad fares (common travel in France) about a half-cent a mile; in England, six or eight times that amount.

And, oh, yes, the Grenoble Opera! It must have had the most unique chorus in the world: a very tall lean and a very fat short girl vied with a dozen other scrawny ones. The tall one's arms were always akimbo when the others' were folded, or the short one hopped when the others knelt. But then the price was only 8 cents.

"Monte Carlo, where, gambling all the money I had left from my trip, I won enough to last me the rest of my life."

To introduce the account of my trip through Italy, I must first take up the story of Martinelli, as I have called him, giving you, of course, only a brief sketch.

This splendid young fellow of twenty, fair-haired, clear-eyed, and strong, a foreman in a Kentucky mine, was on his way to Italy as was the other Italian in the blue overalls, to seek a bride. But Bernardo, as I shall call him, knew the young lady he was going for. He had met her four years previously in a visit he had made to a small town in Northern Italy in search of some clue concerning his parents whom he does not remember ever having seen but who were said to have come from this certain town. He found no trace of them, unfortunately, and he has found none to this day, but he met the young lady to whom he was now returning.

But once within the border of Italy, he was seized by the military authorities, and despite his protestation, declaring he had been born in America and had attended American schools, he was forced to serve in the army, at 40 cents per month, having as he had an Italian passport, the American passport having been denied him since he could not furnish proof of his birth. Bernardo claimed his right to freedom on the ground, if there were no other, of having visited Italy four years before and of living in America before the military draft age. But presently the authorities found records of their own that proved to them that this was "Bruno" Martinelli, who had escaped service, and therefore he must serve, and he must take the name "Bruno." He was, of course, impressed immediately into service; and there he is, and there he will be for eighteen long months. And all because he went on a journey to find out who he is, where he was born, and who his parents were.

I went to see my friend. He sits wondering whether or not his mother and father left him on some door step and ran away or if he was once kidnapped, and doubtless his mother and father are searching for him night and day, and have not given up hope of finding him as he has not of finding them.

Now he is a single robot of those hundreds of thousands of soldiers that one sees everywhere in Italy as part of a madman's dream to gain power and glory, filling men's minds with the error that might is right, and leading them to believe that they can win power through the sword. Italy is now an armed camp. From Turin to Venice, from Milan to Naples, I saw soldiers and officers everywhere, and everywhere prep-

arations with a view to war. But every mouth is muzzled. Men whisper. Forty students who distributed tracts were sentenced to fourteen years' imprisonment. A famous Italian historian has been refused a passport to go to America to lecture. Only one word is accepted in all of Italy. The negative right, the simplest sort of right of any citizen from any system of government that can be called enlightened, or even civilized, is that right of political freedom. But think of being robbed of that right of all men to think for themselves and to speak out what they believe to be true, to achieve that positive freedom, without which, despite whatever freedom they may possess, they are slaves! So, all that Garibaldi won is lost; a character of Dante's is strutting through the land.

It would make this account too long to describe my wanderings through that beautiful country. I visited all the principal cities, and each has a story worth the telling. In stopping at Padua and talking with some University students, I was told that the cause of all this commotion was a statement of some foe that "Italy in a dying nation." Instead of showing good sense and laughing at it, for certainly it is not true, they have become blinded to the power of reason and love. Italy is alive in its wealth of art. And if only they knew that the only life that counts is the beautiful, the good, the true!

Of course, I visited the monuments throughout Italy. I hung and clung for three hours to a fluted column in the cathedral of Milan to see the coronation of Cardinal Tosti. I attended opera at the Scala. I rode down the Grand Canal in a gondola, and gazed with amazement at St. Marks and the Ducal Palace in Venice. I roamed about Bologne and moused about Florence. I was thrilled with the sight of Vesuvius, and enthralled with that of the Bay of Naples. I returned to Rome, visiting all that one goes to Rome to see, from the Catacombs to St. Peter's. But what really touched my heart were the graves of Shelley and Keats who lie quite secluded in the little English cemetery. I visited Florence once more, stopped at Pisa, then at Genoa, then moved along the coast to Monte Carlo, where, gambling all the money I had left from my trip, I won enough to last me the rest of my life.

Now, I have not even mentioned Switzerland, the playground of the world, the palace of nature; but I must leave this for Dean Monin to tell about.

And I cannot say more than a word about Paris, where, soon, we were spending a few weeks before crossing the English Channel. As I looked up at the Eiffel Tower I thought of you men, how your eyes would bulge to see this work of engineering skill. And I stood wishing that some day you may see it. And that some day you may see the Louvre, Notre Dame, the Arc de Triomphe under which a torch flares vividly in the wind or glows quietly in calm. Every hour of the day, hundreds of men pass this light, and every man lifts his hat. And then there is the Champs Elysees where, on Sunday afternoons, you may see hundreds of children, of all ages from seven to seventy, exchanging postage stamps. And not far away, the Punch and Judy shows. Along come little ones riding on a donkey, and we are reminded of Spain, where donkeys peered over the walls, grazed on the palace lawns, drew fruit carts, jostled jockeys jogging along with water jugs on either side, and where they brayed or balked at will.

Now we are in England, living in the midst of primroses, daffodils, anemones, and the songs of birds such as we have never heard. And now we are waiting for the nightingale.

I could write as much about England as I have already written. I shall mention only a few things, however. We are impressed with its loveliness of color and character, its neatness, its quaintness. We, accustomed to the beautiful common characters that Lincoln so touchingly described, are depressed at the distinctions in classes that still persist. And we are sad to see so many unemployed and to learn that those who have work are paid so miserably: a headgardner, $7.50 per week; a bus driver, $12.50; and out of this they must pay rent, buy food, and support a family! We are struck with the difference, in respect for law. I attended the Assizes several days and saw two policemen sentenced to eighteen months hard labor for accepting a bribe of sixty cents at a race; three men sentenced the same for shooting rabbits by night on a Lord's estate, etc. The next day, we read that a gang had blown up an armored pay-wagon near Pittsburgh; and the following day, that there had been a jail release at Joliet of prisoners waiting to be hanged; and about two weeks ago, that Chicago is the most lawless city in the world, with a murder a day.

I know you men would smile if you could see us traveling. Now, with all our baggage, we carry along a collapsible carriage and a galvanized iron baby's bath tub. But we check them along as we go, put them out prominently where anyone may see them, and smile. If the proper study of mankind is man, we have certainly been studying. We have found that men are essentially the same wherever we have been. We may have misunderstood, and we may have been misunderstood but we have tried to see clearly and steadily and whole. We have been glad for our experiences; we shall be glad to return to the lusty and vigorous life of America; we shall work for a clearer understanding among mankind. We have had a glorious year. We hope you may have one like it. We have lived. We hope we may live even more abundantly.

Yours sincerely,

WALTER HENDRICKS.

## THE STATUS OF THE ILLINOIS WATERWAY

*(Continued from page 135)*

level can be maintained. Navigation would thus be benefited.

The Supreme Court will decide whether or not any water can be taken from Lake Michigan. Congressional action will be necessary to decide as to the amount of water that can be withdrawn.

The value of the Waterway to the people of this and other states is the saving that comes from the consequent lowering of freight rates.

The Waterway passing diagonally through the State of Illinois and the great corn producing belt, makes it possible to ship by water some 200,000,000 bushels of grain that are produced within 40 miles of trucking distance of the river. This traffic, if it causes a saving of 5 cents a bushel, would be a benefit of $10,000,000 annually.

In the region of Chicago some 30,000,000 tons of coal are consumed annually. This coal is brought largely from the mines in the southern part of the State. Surveys have been made which show that it is feasible to develop such a water course as the Big Muddy River leading from the coal producing districts to the Mississippi River and to make the shipment of a large portion of this traffic at considerable saving, possibly amounting to $15,000,000 annually.

There is imported through New Orleans annually 210,000,000 tons of sugar, 30,000,000 tons of coffee, 40,000,000 tons of rice, and 20,000,000 of canned goods. Enormous savings are possible by water transportation on these shipments.

The lower freight rates on some of the natural resources along the water course would enable the development of shipments into eastern markets.

Undoubtedly new industries will develop as soon as the Waterway is in operation, and opportunity will be afforded for expansion of present industries that are now handicapped by prohibitive freight rates.

There are pending negotiations for water power rights held by public service companies, and some additional property has yet to be acquired. These matters must be settled before the last contracts can be let.

# THE ARMOUR ALUMNUS

## J. WARREN McCAFFREY, '22, *Editor*

### AN EXTRACT FROM THE *LINOTYPE NEWS* OF MARCH, 1927

"For four months now, since November 1 of last year, the American Newspaper Publishers' Association, with a membership of nearly 500 newspapers, has been cooperating directly with member papers through a mechanical department managed by W. E. Wines (*Armour, '07*), a man well qualified for this important position.

"It is the aim of this new department to be of specific, tangible service to publishers the country over in the analyzing and meeting of mechanical and production problems. It is the ambition of Mr. Wines, himself, to cooperate in every way possible not only with the business management of the paper but with those men in direct charge of the various operations of a plant—the composing room superintendent and foremen, the heads of the stereotyping, engraving, press and other departments.

"Mr. Wines has a scientific and practical background of training for his position as manager of the mechanical department.

"He was educated in Chicago public schools and the Armour Institute of Technology. After leaving Armour, he spent two or three years doing mechanical and electrical construction work and drafting with two Chicago concerns.

"Then for eight years he was mechanical superintendent with the Minneapolis *Tribune*, beginning in 1900.

"Later he became superintendent of the buildings of the University of Minnesota. A year afterward he joined the Chicago *Tribune* as mechanical engineer and remained three years. Then for a year he was mechanical superintendent of the New York *Times*.

"For four years, Mr. Wines conducted a poultry farm on the outskirts of Minneapolis. Then he joined the Globe Electric Company of Milwaukee as superintendent. From this connection he joined the teaching staff of the University of Wisconsin, at Madison, as assistant professor of mechanical engineering in the extension division.

"While connected with the University, he wrote for the *Wisconsin Engineer*, school publication, a two part detailed and illustrated story on the *Mechanical Equipment of a Modern Newspaper*. In 1923, a book of his, *Strength of Materials*, one of the engineering education series brought out by the university, was published by the McGraw-Hill Book Company, Inc., New York City.

"So Mr. Wines is eminently qualified to manage successfully the activities of the mechanical department of the American Newspaper Publishers' Association."

---

We received a letter recently from C. E. Tweedle, '25, announcing his employment by D. M. Kable and Company, consulting, mechanical, and technical engineers and representatives for manufacturers in foreign countries. Their office is at 127 North Dearborn Street. It is evident that Tweedle is enthusiastic on the question of foreign trade, because this is his second position since graduation in that line. He formerly was with T. J. Davis, doing consolidating exporting.

### ROBERT B. HARPER

#### A Biography

Robert B. Harper, although he was born in Evansville, Indiana, is a product of Chicago schools. Graduating from Chicago Public Grammar School in 1896, he spent four years at the South Side Academy. After one year at the University of Chicago, he entered the Armour Institute of Technology, graduating in 1905 with the Bachelor of Science degree in Chemical Engineering.

Robert B. Harper

Four years later, he received the advanced degree of Chemical Engineer.

Upon his graduation from Armour, Mr. Harper was engaged by the Peoples Gas Light and Coke Company as Assistant Chemist. In 1906, he became Chemist in charge of Laboratory, then Chief Chemist and Chemical Engineer, and now is Chief Testing Engineer and Superintendent of the Testing Department.

The name of Robert B. Harper is to be found on the roll of many technical societies. He was director of the Illinois Gas Association for four terms and director of the American Gas Institute for two terms. In 1915-1916, he served as vice-president at the International Gas Congress at San Francisco. In addition, he has taken part in the activities of the American Gas Association, the American Society for Testing Materials, and the Western Society of Engineers. From time to time, he has presented technical papers and articles before these and other groups.

In addition to his technical contributions, Mr. Harper has served in non-technical fields. He is a member of the Chicago Association of Commerce, the Collegiate Club of Chicago, and the Fort Dearborn Athletic Club. He helped to organize the Advance Club, now called the Peoples Gas Club, which is an employee's organization for social, educational, and recreational benefits.

### ARMOUR ELECTRICAL WINS FAME IN FIELD OF AVIATION

The following statement appeared in a Buffalo daily paper of recent date.

"H. Ralph Badger of Buffalo, New York State Governor of the National Aeronautic Association, on Monday was a speaker at a meeting held by the Chamber of Commerce of Schenectady in a move to raise a $100,000 fund for the establishment of an airport for that city. He has also at present invitations to come to some seven other cities of the country for like addresses.

"Mr. Badger is also scheduled to be one of the speakers at the meeting in Washington of the Inter-American Commission on Aviation, to be held under the auspices of the Pan-American Union, for the furtherance of air transportation between cities and countries of North and South America. This meeting will be held at the national capitol . . . . with the meeting of the national convention of the United States Chamber of Commerce. An 'Aviation Exposition' will be one of the features of the gathering."

Mr Badger was active in the building of the Buffalo airport, said to be the best landing field in the country. He received his Bachelor of Science degree in Electrical Engineering with the class of '08. In 1912, the degree of Electrical Engineer was conferred upon him.

---

Professor Wilcox, who is the present chairman of the local branch of the Institute of Radio Engineers, told about the very interesting joint meeting held by that society and the Western Society of Engineers in Fullerton Hall of the Art Institute on March 18. The feature of this meeting was an excellent talk given by A. A. Oswald, '16, of the Radio Research Department of the Bell Telephone Laboratories in New York City. The subject of his talk was *Technical and Engineering Features of the Chicago-London Telephone System.*

Mr. Oswald, a former Chicagoan, has been working on Trans-Atlantic telephony for many years. He gave an illustrated description of the whole system at this meeting, together with a short history of its early stages and development. He, himself, played a large part in the designing of the equipment, having spent a considerable time on this work in London, England.

---

In the Field Department issue of the monthly bulletin put out by the Bureau of Safety we find considerable space devoted to an article on *Safe Operation of a Gas Plant* written by Stanley Owens. Owens graduated from the electrical department last June and has been employed since as a field representative by the Bureau of Safety. He was recently married to Miss Marie Kasson and now lives at 7011 Merrill Avenue, Chicago.

---

Another marriage recently took place among the younger or embryo engineers graduating from Armour Institute. On April 16, Miss Olive Doerr became the wife of George J. Taylor, '25. He graduated in electrical engineering and has been representing the Cooper Hewitt Electric Company, 37 W. Van Buren St.

# THE UNOFFICIAL OBSERVER

## By JAMES C. PEEBLES, '04

### THE FRESHMAN SAND-SHAKE

For a day or two after registration, the Freshman was busy running about in ever-widening circles, making out his program card and enrolling in his different classes. When in the course of a brief conversation with Dean Palmer he described thus the path which he had been following, the Dean remarked that this was a new circle in his experience, and suggested that possibly the Freshman's path might have been a spiral. Thus the habits of thought acquired in a life-long practice of an exact science are not overcome in a day, and it is perhaps just as well that they are not. Such a man should find comparatively easy the transition from transcendental functions to social functions, from progressions to personalities, from Fourier's series to freshmen so serious. He who has grown gray in the solution of mathematical equations should be able to discover the elusive $x$ in the human equation.

Soon the Freshman's spiral orbit (here again he wondered what the Dean would say) reached Machinery Hall, a building of which he then became conscious for the first time. His program card called for *founding* and inasmuch as the word was entirely new to him, he was in doubt as to what he was expected to found. He went into the building, mounted a short flight of steps and entered the shop on the first floor. He pushed the door open timidly and, without stopping to look much about the shop, made his way to the instructor's office at one end of the room. The man at the desk looked up from his work as the Freshman entered with the announcement that he had come to enroll in founding.

The instructor, who had been familiar with shops and tools from the time of his earliest recollection, wondered how the Freshman could have come through this particular shop without noting its identity. He recalled a previous occasion when an upper classman, who certainly should have known better, had made this identical mistake. At that time the instructor's Celtic wit had administered a well-deserved rebuke. With the gravity of a judge on the bench he had said to the offending student, "Young man, you have made a mistake; this isn't the foundry, it's the library."

Such a reproof was of course entirely unmerited in the case of the Freshman; even if he had looked about as he came through the shop, it was by no means certain that he would have been able to identify it. One does not develop a fine discrimination about tools and machinery during a boyhood spent amid the bucolic surroundings of a farming community, where the Ford garage is the holy of holies of the mechanic arts, a place of mystery to every boy in town, and where coöperative threshing is the acme of organized industry. So the instructor explained patiently to the Freshman that he had come into the forge shop by mistake, and that he would find the shop for which he was looking on the top floor of the building.

The Freshman climbed the stairs to the fourth floor, slipped quietly into the shop and stood looking about, determined, if possible, to make sure that he was in the right place. On the concrete floor there were several neat piles of black dirt, and near one of them a man was at work sifting the dirt into a battered wooden box about four feet square. Here was something that at least looked familiar; many times in the early spring he had gone through that identical operation, helping to make hot-beds on his grandfather's farm. The words *power plant* which he had seen while examining the curriculum came to mind, but, with an air of extreme sophistication, he dismissed it as being too fantastic. Later in his course he was to learn how much of a power plant really begins in that operation which he was watching.

Finally the Freshman, more cautious after his experience in the forge shop, approached the man at work on the floor and inquired rather timidly, "Is this the founding shop?" This was a new one in the molder's experience and he paused in his work to look the speaker over carefully. He thought for a moment that this might be the lad for whom the whole first year class was named but he quickly decided that the boy was not fresh, just green. But no categorical answer was possible to the Freshman's question; no tradesmen are greater sticklers about the language of their craft than the molders, and he refused to say whether this was or was not the founding shop. He simply directed the Freshman to the instructor's office, where the question could be decided by an authority.

In the office the young man repeated his question and the instructor hesitated only an instant. Like many a wise man before him he assumed a graceful position on the fence and came through with an equivocal answer, one that satisfied both the Freshman and the molder who had followed the latter to the office door. "Yes, this is the foundry." Quickly the details of enrollment were finished and the student was told to report the next afternoon for his first shop period.

On his way out the Freshman stopped to look the foundry over more carefully. Two other students had just come in and as he approached them he heard one remark: "Yes, that's the cupola where they melt the iron." So this thing of steel and firebrick which stood in the center of the shop was called a cupola. It was rather different he thought from the architectural monstrosity atop his grandfather's barn, which he had known by that name. That cupola had been inhabited by countless pigeons which sunned themselves on its roof and built their nests on the inside. While still too small to wield the tools of the farmer's craft in cow-shed or barn-yard, the Freshman had been required, at regular intervals, to clean that redolent rookery, thus gaining his first experience in applied scatology. Later he became master of all its art and mystery as chief engineer of a manure spreader on his grandfather's fields. In the presence of this other cupola the Freshman decided that he must do some revising of notions and redefining of terms before he went far with this engineering course.

When the class met the following day the instructor took them into the classroom and lectured to them for an hour. Here it appeared that the black dirt in the shop was green sand (it didn't look green to the Freshman), the sieve which he had seen the molder using was a riddle (this shop was full of riddles), and the box into which the sand was put was a flask. The Freshman wished that there were some other name for that box which, he discovered later, had neither top nor bottom. What would they think back home in the original bone-dry state when he mentioned flasks in his letters? He also learned that the flask had two parts, the drag at the bottom and at the top, not the cork but the cope. Right there he decided that he must develop some sort of drag with the instructor if he wished to cope successfully with this course.

When the Freshman left the shop at the close of the period, he went with a far different feeling from any he had ever known in the lecture hall or classroom. Many times in his theoretical work, he had felt as if he were simply cruising along the shores of engineering without an opportunity to land and explore the country. But in the shop he felt as if he had landed with both feet; here he was making something, doing as it seemed to him, actual engineering work instead of talking *about* engineering. The thought was somehow immensely encouraging and inspiring; not only would he learn about the forces of Nature and the laws which govern them, but he would actually control them with his own hands in the making of something new and useful. When he studied about the steam engine for the first time back home in high school physics it was an incident, but when an indulgent locomotive engineer let him pull the throttle it was an event. So it seemed to him now; he was reenforcing theory with practice, knowing was developing into doing, incidents were becoming events.

### LABORATORY LEXICON

*Machinery Hall*—A place where Theory, Reason's fair-haired child, meets Practice and gets dirt on her lily-white hands.

*Civil Engineer*—One who is not criminal.

*The Measure of a Man—I am* divided by *I might have been.*

*Band*—A musical instrument played by an acrobatic gentleman called the director. He operates it by shaking a stick at the instrument, his left fist at the tuba, and his coat tails at the audience.

# THE ARMOUR ENGINEER

Published Quarterly by the College of Engineering

ARMOUR INSTITUTE OF TECHNOLOGY

Vol. XVIII May, 1927 No. 4



STAFF

WM. W. GOTHARD ..... *Editor*
JAMES D. GREEN ..... *Business Manager*

W. J. ZENNER ..... *Assistant Editor*
C. A. GUSTAFSON ..... *Assistant Business Manager*
J. J. DOHENY ..... *Articles Editor*
T. P. CAMP ..... *College Notes Editor*
J. W. KENT ..... *Fraternities Editor*
H. KOHN ..... *Societies Editor*
F. D. PAYNE ..... *Athletics Editor*
C. W. BURCKY ..... *Engineering News Editor*
J. W. URBAN ..... *Art Editor*
H. B. RITMAN ..... *Art Editor*
C. LONG ..... *Humor*
L. A. OHLINGER ..... *Publicity*
F. C. STEINHAUS ..... *Publicity*
M. T. GOETZ ..... *Photography*
L. K. SAIRS ..... *Circulation Manager*
W. A. MORGAN, C. VANDER MOLEN, A. B. STEVENS ..... *Editorial Assistants*

PROFESSOR C. E. PAUL ..... *Advisory Editor*
PROFESSOR J. C. PEEBLES ..... *Unofficial Observer Editor*
MR. J. WARREN MCCAFFREY ..... *Alumni Editor*


**Our Slogan:** ***Make The Armour Engineer the best technical college publication in the country***

*Ah, but a man's reach should exceed his grasp,*
*Or what's a heaven for?*
—Robert Browning
*The Faultless Painter.*

THE ARMOUR ENGINEER is at a loss to express adequately, regret at Dean Monin's retirement from active professional life.

In considering the progress that this publication has made during the eighteen years of its existence one can see, throughout, the guiding spirit of Dean Monin. He has been our adviser and our friend. Our problems became his problems, and the most feasible solution was always worked out.

We have devoted several pages of this issue to our dean. It is not by way of honoring him. That is beyond our slight power. He, in his untiring efforts to build manhood out of the raw material—youth, has unconsciously covered himself with a cloak of enduring honor. Instead, it has been our desire to set forth something materially suggestive of him, that in the future we may turn to it, and experience a spiritual, or mental refreshment, as we so often have in our personal contact with him.

We have presented his farewell address to the senior class. It is typical of his former talks—extemporaneous, bulging with a philosophy that works, as delightful as it is sincere. Following that we have messages from the faculty, alumni and students.

We have said what we have been able to say. This in itself has fallen short of its mark. Therefore, let the tribute of THE ARMOUR ENGINEER to Dean Monin be, not so much what we have said, not so much what we have not said, but what we as an institution, guided and influenced by Dean Monin, stand for in the lives of those whom we may influence.

JOHN CORNELIUS PENN, as Acting Dean of Engineering, and Claude Irwin Palmer, as Acting Dean of Students, are at this time extended the sincere good wishes of THE ARMOUR ENGINEER for complete success in the performance of their new duties. In the past we have come in contact with these men a great number of times. Our relations have always been most pleasant. Cooperation has been our meeting ground. Understanding has motivated our purposes. Experiences have shown that both Dean Penn and Dean Palmer are ready and willing to go more than half of the way—are even willing to inconvenience themselves, in helping us in our work. We are happy in the spirit that pervades our associations together. We pledge ourselves to carry on this spirit—to continue to work in harmony with the new deans—to unceasingly strive toward the complete solution of our mutual problems.

ON the ninth of June, some one-hundred forty-four young men will leave Armour Institute of Technology as graduates of a recognized college of learning. In so doing, they assume responsibilities commensurate with their training and abilities. Whether or not all of them meet the issues squarely will be a matter dependent upon the individual. In all cases, however, each will pass through some sort of transition, broadening or readjustment period. The depth of character of the man will be indicated when he completes the plan of his life's program, grounded upon his basis of values, at the end of this period.

"The phrase 'broadening the engineer' is a euphemism when it is employed to designate a program purporting to lead the individual engineer to success, spelled in dollars.

"Focussing attention on the $$$, is not broadening the engineer nor advancing the profession. It is a narrowing of ideals. The modern engineer needs to be grounded in economics, but it takes more than a course of business training to make a successful engineer.

"It is false guidance to deprecate the importance of sound technical training and ability. The professional success of any engineer depends, in the last analysis, upon his true professional worth.

"It is, of course, expected of every professional man that he be educated and cultured, with a broad background of training in the liberal arts and sciences, with broad interests in things outside of his technical problems, and with a *broad vision* of his obligations to his profession and to society."

MANY still lack much of physical comforts but few today lead such a dull life as must have been the lot of our grandfathers. Mud roads, snow-drifts, and horseback locomotion confined them to an extremely limited horizon. Oppressive lonesomeness drove thousands insane.

The modern post office, the telephone, the radio, the railroad and the automobile, have dwarfed distance. I travel twenty miles to work in an automobile, a distance which would have been an all-day trip for my father, twenty-five years ago. Modern water, lighting, heating, and cleaning systems have added to our comfort and relieved us from endless drudgery. In my living room are incandescent lamps, a telephone over which I can talk to any city in North America, a thermostat which keeps the room at an even temperature, and many other conveniences unknow a generation ago.

My music cabinet contains records of the greatest music in the world. I can hear this music, sitting in my easy chair, and I can select my own program. Within arm's reach shelves of books contain the most profound and beautiful thoughts of the age. I can spend an hour with Benjamin Franklin or with Rudyard Kipling or if I crave humor, with Mark Twain. For a few cents a day I have delivered to my door the news from the four corners of the world in daily, weekly, and monthly installments.

My children are receiving a better education than the sons of kings could command a century ago.

I, just an ordinary citizen with an ordinary income, enjoy all these things; tens of thousands have just as much as I—and more.

Were the good things of life ever so easily at the command of everybody as they are today? Yet don't we all do a lot of grumbling that we haven't any right to do? And if we aren't careful, isn't there danger that we will upset the greatest civilization the world has ever known?

—Condensed from *Nation's Business.*

# COLLEGE NOTES

*News of Societies*

## AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS

The Armour Branch of the American Institute of Electrical Engineers is completing another successful year in the stimulation of student interest in the electrical engineering field. During the past year a number of prominent men have spoken before the Branch on subjects of great interest to embryo engineers. On December 2, a very interesting meeting was held in conjunction with the Armour Branch of the Western Society of Engineers at which Mr. Morrow of the Chicago and Western Indiana Railway spoke on some of the problems of railway terminal development for Chicago. We were very fortunate in securing Mr. M. B. Long of the Bell Telephone Laboratories to speak to us on January 13, on the subject of Electrical Communication. Mr. Long accompanied his talk with slides illustrating some of the problems of telephone engineers. A working model of a modern steam power plant and electrical distribution system was demonstrated on March 3, at a meeting of all the engineering societies at the Armour Institute of Technology and sponsored by the Armour Branch of the A.I.E.E. Mr. W. A. Durgin of the Commonwealth Edison Company gave a talk pointing out some of the features of the working model.

The annual fall smoker of the A. I. E. E., sponsored by the senior electricals, was given at the Theta Xi house on November 17, and was proclaimed one of the most successful smokers ever held by the A. I. E. E. We have discovered, among our group, a native of the South Sea Islands who was kind enough to entertain us with a bit of his native art. The second smoker of the year, sponsored by the junior electricals, provided a genuine good time. It was held at the Sigma Kappa Delta house.

## WESTERN SOCIETY OF ENGINEERS

During the past year, it has been the policy to obtain speakers for the meetings of the Armour Branch of the Western Society of Engineers who were not only prominent in their field of endeavor but who were able to present their wealth of knowledge in a way attractive to undergraduates. The complete list of the speakers, and their subjects, that we have had to date are as follows:

Mr. Morrow, president of Western Society of Engineers; Terminal Unification.

Mr. Thomas Browning, patent lawyer; Development of Inventions.

Mr. Murray Blanchard, hydraulic engineer; Division of Waterways.

Joint meetings are not included in this list.

## AMERICAN SOCIETY OF MECHANICAL ENGINEERS

The American Society of Mechanical Engineers is enjoying a very successful year, because of the great interest shown by the members. This was well demonstrated at the smoker which we held on Tuesday, April 26. The attendance was very gratifying. Among those present were Professors Gebhardt, Libby, Perry, and Roesch. It was also very pleasant to see some of our graduates. In the midst of the smoking, card playing, singing, and checker playing, time was called, for a program which was arranged by W. E. Vevurka.

The program was opened by selections played by the famous A. S. M. E. orchestra. O. W. Sandborg next gave us a reading, *The Shooting of Dan McGrew.* This was well done and received applause. A group of three men constituting a trio gathered around the piano. It was soon found out that as songsters these young men would make good engineers. Nevertheless, all those present joined in to form a chorus, to sing some old timers. We finally concluded that we were all engineers and went on with the rest of the program. A. B. Millard gave us a synopsis of an operetta which was to have been enacted by "Miss" L. E. Johnson and E. B. Kapke. Their act, however, did not fit the epitome, but Millard explained that it was perfectly all right since his clothes did not fit the occasion either.

One of the best features of the evening was entered by our talented young man, S. I. Cohen, who gave us a few dialogues. He caused an uproar of laughter which took five minutes to calm down.

Then came the eats and some more card playing. The party finally came to a close when most of the members left, due to traveling inconveniences.

The society has had many regular meet-

## THE OFFICE OF THE DEAN

**JOHN CORNELIUS PENN**

Our Acting Dean of Engineering is John Cornelius Penn, B.S., C.E. He is also Associate Professor of Civil Engineering. He received his Bachelor of Science degree with the class of 1905 from Armour Institute of Technology. In 1910, he received his Civil Engineering degree. During the period from 1905 to 1910, Professor Penn was employed by the City of Chicago as Assistant Engineer in the Bureau of Bridges and Harbors. From 1910 until 1921, he served at Armour Institute of Technology as an Instructor and later became Associate Professor of Civil Engineering. During this time, from 1906 to 1921, he held regular classes in the evening school. From 1921 to the present time his duties have been extended to include those of Assistant to Dean Monin and Examiner.

Professor Penn is a member of the Western Society of Engineers, the Society for the Promotion of Engineering Education, the Knickerbocker Club of Chicago, and the University Club of Chicago.

His appointment entails an enlargement in the scope of his activities rather than a change of work. As a result, he will continue to be the examiner of prospective students, the compiler of statistics, and the designer of programs. Also, the Civils of the future will not be deprived of the pleasure of Astronomy and Water Power with him.

His work as Acting Dean of Engineering will be principally with President Raymond and the Faculty.

**CLAUDE IRWIN PALMER**

Claude Irwin Palmer is perhaps best known as the author of a series of text-books on mathematics. He has recently accepted a new office, that of Acting Dean of Students at the Armour Institute of Technology, which will place him before the student body in a new light. Throughout his twenty-four years of teaching at Armour, he has always shown a personal interest in students and has been found especially sympathetic toward those in trouble. This quality of sympathetic understanding, no doubt, had much to do with his appointment.

Dean Palmer was born in Michigan, coming from a pure Yankee family. He graduated from the University of Michigan and did graduate work at the University of Chicago. Before coming to Armour, he taught in public schools in Michigan for eight years. In addition to the new office, he is Associate Professor of Mathematics and is acting head of that department.

Eleven text-books on mathematics bear the name of Claude Irwin Palmer as author or co-author. A statement from the publisher shows that, for *Practical Mathematics,* the first of the eleven to be published, the total sales to January 1, 1927, were 121,006 copies of the small volume and 155,977 of the combined edition. If all the copies of this book were to be placed side by side on a single shelf, a shelf three and seven-tenths miles long would be required.

ings in which we heard some interesting talks and lectures. Joint meetings with other engineering societies made the schedule complete.

## BAND

From a purely physical standpoint, we might suggest that there are less effective methods of whipping an athlete into condition than wrapping a tuba around his neck and letting him furnish a controlled stream of air through the mouthpiece while he marches several times around Ogden Field with a step that would put the old German Goose Step to blushes of shame. The band asks for the tolerance and forbearance of the student body during those first few days when it is rediscovering how to keep the mouthpiece to a lip in spite of sudden pitfalls and obstacles. After the first week is over and the knack has come back, no excuses will be necessary. Everyone remembers the effect of the band on parade last circus day.

## FLASK AND BEAKER

Flask and Beaker, the professional chemical club, held a smoker and formal pledging on the evening of April 7, when the following men were invited to wear the gold and red ribbons of the organization:

J. E. Candlin
J. W. Heimaster
F. O. Johnson
M. P. Johnson
U. G. Naef

At this smoker the chemist's ability to stew up rare and potent concoctions exerted itself to an extent not hithertofore observed, in the form of a delicious ice cream derivative that would have made the most exacting French chef turn green with envy.

The weekly meetings have continued throughout the semester. The first shipment of Flask and Beaker pins has recently arrived. At present the men mentioned above are busy completing their quota of paddles and writing their theses. These will be presented at the initiation banquet to be held during the latter part of May or the first part of June.

## AMERICAN INSTITUTE OF CHEMICAL ENGINEERS

Some very interesting meetings have been held within the last few months. As mentioned in the last notice, R. E. Wilson, of the Standard Oil Company, spoke on *Iso-Vis and Winter Lubrication* on Thursday, March 31. His talk was very well presented and everyone who attended received an insight into the principles and difficulties involved in the lubrication of automobile engines, particularly under the conditions imposed during winter and low-temperature operation.

The annual spring banquet was held on Thursday, April 26, and was a success from every point of view. The walls of the Indian room of the Fort Dearborn Hotel served to prevent the noise of the banqueters from penetrating to the heart of the loop. Many a good story was told during the consumption of a grand and glorious six-course repast.

Jimmy Green was on hand and entertained nobly with his little skit, *The Adventures of Diamond Jack.* Professor Schommer gave a wonderful talk on *The New Football Rules and Assorted Sport Topics,* which was followed by the presentation of the Phi Lambda Upsilon award of a handbook to Seymour Goodheart for his achievement of maintaining the highest average during his freshman chemistry course. The assembled multitude was very fortunate in having the opportunity of hearing Mr. L. W. Spring, Chief Chemist and Metallurgist of the Crane Company, talk on *Ferrous and Non-Ferrous Metallurgy in Chemical Engineering.* Mr. Spring is a very entertaining talker and his presentation was further clarified by a series of charts and actual samples which illustrated his points.

On Thursday, May 5, Dr. W. D. Harkins of the University of Chicago addressed the group in a joint meeting with the Fire Protection Engineering Society on *Atomic Stability and Related Problems.* Professor Harkins is one of the country's foremost authorities on atomic structure and his researches are of fundamental importance. It had been several years since Dr. Harkins has spoken at the Institute and it was a pleasure to welcome him back at this time.

---

At a meeting of the Business Officers of Illinois Colleges, held at the University of Illinois on May 4, our Comptroller, Mr. George S. Allison, was elected president. Lloyd Morey, Comptroller of the University of Illinois, was elected vice-president and Clifford Guild of Illinois Wesleyan University was elected secretary-treasurer.

Representatives of 30 of the 45 colleges and universities of Illinois were present. They discussed the business affairs of their individual institutions and heard talks by a number of prominent men.

---

Several of Professor Amsbary's classes were extremely fortunate this last month in that they were privileged to hear Mr. Earl H. Reed, the well known author, read selections from several of his works. He was very well received, and many expressed the hope that he would return soon and give a longer program.

---

That the honorary fraternities are active is indicated by the novel and striking method of bringing the meetings of the A. S. M. E. to the attention of the student body. It would be well if all the tasks imposed on pledges combined pleasure with utility as well as this does.

## ARMOUR TECH MUSICAL CLUBS

With the close of the school year, the time comes when we can look back and figure up accounts with a feeling of dismay at our shortcomings and honest satisfaction and pride in our achievements. The officers of the Armour Tech Musical Clubs feel that although the clubs are not in the position that they might be, they represent the work and effort of the students with the limited time that they have for musical work. Let us review the results of a year's time, putting the sheep with the sheep and the goats with the goats.

The first need of the clubs is more time for practice work, an impossibility at a school like Armour where the time is limited and the only place of practice is the Assembly Hall. It is true that only practice makes perfect and rough spots can only be smoothed over by constant rehearsal and repetition. This, then, is one failing. Another lies in the membership of the clubs. In a school the size of Armour, we should have a band of fifty pieces and an orchestra of at least forty pieces. But again, lack of interest and time discourage attendance and constant advertising of the clubs before the student body fails to draw out the other ten per cent that we so need.

But turning to the deeds accomplished, we can turn the cloud inside out and present a rosy interior. In the first place, two new organizations have been added to the club in the form of the quartette and the Stresses and Strains. They provide the lighter forms of music and serve as the siren call to lure the jazz mad student on to the shoals of Beethoven and Mozart. Their popularity has justified the work of their founders. In addition, the officers assisted in the founding of the honorary musical fraternity, Pi Nu Epsilon, which in the future is destined to play an important part in music at Armour. Finally, we feel that in the giving of three successful concerts during the year at the Institute, we have established a precedent that the officers in the future will do well to follow for, with each such event, a new spirit of coöperation and union between the students is felt.

## GLEE CLUB

The glee club has been laboring long and arduously ever since the last concert, for appearances not far in the offing. Dr. Protheroe has been working steadily to develop the individual singers into an ensemble worthy of the words *trained chorus.* Only one versed in the difficulties attending the training of a glee club or chorus can appreciate the work required from the members of the chorus and also from its director, to prepare a new program for a concert in such a short time interval as has elapsed between the Spring Concert and the Home Concert. The members of the organization report, however, that there will be an entire new program ready by the first part of May when the Home Concert will be given.

In addition to the preparations for this concert, the Glee Club is also preparing for a radio concert to be given in the near future. The double quartette, that offspring of the Glee Club, has been very active during the last semester. Being few in number, it is, of course, much easier to work with, and takes much less time to prepare a program. It has appeared several times at various functions given outside the school and has acquitted itself nobly on every occasion. We look to this organization to provide some very original and, at the same time, well polished numbers at the concerts in the future.

## STRESSES AND STRAINS

That the Stresses and Strains have at last filled a long felt need at Armour is apparent in that, during the past few months, they have appeared at numerous functions at the Institute in addition to appearing in the Home Concert. At the Architectural Banquet, given in honor of the freshmen initiated into that society, the boys helped contribute to the general festivities and were pronounced a great aid to digestion. Besides this, they entertained at the Junior Banquet with a peppy line of rhythmic rhapsodies and college classics in a manner worthy of the Orpheum circuit. Incidentally, they furnished the music at the dance following the Senior Reception and Open-House night, two occasions at which the old gym glowed with light and gayety.

# FRATERNITIES

*The Armour Spirit is Nurtured by Her Fraternities*

## TAU BETA PI

The academic year is drawing to a close with its accompaniment of the Senior Reception, Senior Banquet, and finally Commencement. With each passing day bringing these events closer, we realize that in a few more weeks, the class of '27, will pass into history, a history replete with achievements and successes in both school activities and classroom work. Let us glance at one page of this ephemeral volume, a page headed, Tau Beta Pi.

Tau Beta Pi stands today in a position of leadership among all the scholastic honorary fraternities at Armour and it is a position commanding the respect of the student body. This record at Armour can only be maintained through the work of the active members and it is necessarily the Seniors upon whom the responsibility finally rests. The class of '27 has caught the torch and kept it burning brightly throughout their leadership of the fraternity's activities. Starting the year with eight men, the active chapter has a membership now of twenty-one with ten additional pledges. The scholastic standards, always high, have been maintained carefully and yet without any sacrifice of the other essential characteristics so necessary to the continued advancement of the fraternity.

At a recent meeting, the following members of the junior class were pledged to Tau Beta Pi:

K. C. Anderson
E. C. Bacot, Jr.
G. A. Crapple
H. T. Dahlgren
E. E. Gramer
L. E. Johnson
E. B. Kapke
W. W. Kerr, Jr.
H. E. Larson
H. O. Snediker

## CHI EPSILON

During the past semester, the activities of Chi Epsilon have been centered on the selection of men worthy to wear the pledge ribbon of Chi Epsilon, honorary civil fraternity. After careful consideration, the following men were chosen:

W. A. Anderson
E. C. Bacot
C. A. Gustafson
W. W. Kerr
C. T. Vander Molen

These men were pledged at a meeting of the Chapter on March 25. They were put through several tests and given several duties and came through in good form. The initiation banquet is to be held on May 25.

## ETA KAPPA NU

In the spring pledging of Delta Chapter of Eta Kappa Nu, the following men were elected to pledgeship:

H. T. Dahlgren
E. E. Gramer
George Kleinert, Jr.
H. E. Larson
G. H. Von Gehr
W. J. Zenner

This promising group of juniors received their pledge pins at a banquet on March 16, at the Electric Club of Chicago.

After a short but tense pledge period, these men were initiated at a banquet held under the guidance of the Chicago Alumni Chapter of Eta Kappa Nu at the Hamilton Club on April 19.

Eta Kappa Nu Spring Initiation Banquet. The initiates form the first row. In the last row, the sixth man from the left is E. A. Goodnow, '22, Western Examiner.

Each year at this time, Delta Chapter offers an A. I. E. E. Standard Handbook to the sophomore electrical who writes the best essay on some subject that is of an electrical nature.

March 9 found twelve men of Delta Chapter at the Cort Theatre. The show *Twelve Miles Out* received our approval. We topped the evening off by having refreshments at De Met's.

Most of the men of Delta Chapter attended the Inter-Honorary Fraternity Dance, The Dance of the year. E. H. Madden was our social representative for this affair.

## SCARAB

Edfou Temple is going stronger than ever and our "every-other-Tuesday" luncheons at Mandel's Ivory room are bringing out more alumni than we had expected. Thanks to brother Hussey, one of the original Scarabs of this temple, and brother Claire, one of the founders of Scarab, we are rounding up all the Scarabs located in Chicago, partly to help educate new Scarabs in the trials of practicing architecture and partly to remind the alumni of the good times they had when they were the center of school spirit at the Institute.

## PHI LAMBDA UPSILON

Omicron chapter held its spring pledge smoker on Thursday evening, March 31, and at that time the red and blue ribbons, depicting the colors of litmus, were pinned on the coat lapels of the following men:

J. W. Heimaster
F. O. Johnson
C. P. Morgan
U. G. Naef
A. D. Watkins

On this evening, the pledges showed up to poor advantage, but they furnished several hours of merriment for the actives and alumni present, who, it might be mentioned, showed up very well.

These men are rapidly becoming acquainted with the ideals and purposes of Phi Lambda Upsilon, and they are working hard to earn the coveted key. On certain days during April and May they were seen wearing retorts with a colored solution in the bulb. As every hour came around they were obliged to change the color of the liquid, which necessitated some expert manipulation of the acid and base bottles.

All the pledges and most of the actives attended the annual Inter-Honorary Fraternity Dance on the evening of Friday, April 29, and quite a few talked over old times with the alumni that also attended in force.

The Initiation banquet this year will be held on Saturday, May 28th, probably at the Hamilton Club.

In closing another live year, Omicron chapter wishes to take this opportunity to extend to everyone, and particularly the men who are graduating in June, best wishes for a successful future. May they continue to carry on.

## SALAMANDER

With the coming of spring, five more men were given the privilege of wearing the pledge badge of Salamander. They are:

O. R. Besch
J. T. Clark
W. M. Horn
R. K. Langan
H. O. Snediker

The pledging of these men brings the chapter roll up to the largest it has been in recent years.

On April 29, the annual Inter-Honorary Dance was held and every Salamander member and pledge attended. It was one of the best dances of the year and, of course, everyone enjoyed it most thoroughly.

Since this will be the last issue of The Engineer, Salamander takes the opportunity

(*Continued on page 146*)

# ATHLETICS

*Baseball Season Opens—Tennis Schedule Published*

## BASEBALL

Armour opened the 1927 season with a 5-4 win over Crane on April 14 at Ogden field. Alexander, one of last year's stars, pitched the team to victory. As this was the first game of the year, he toiled but seven innings and then was relieved by a new man, Simpson. The score at that time was 5-4 and Walt had struck out ten men. Not so bad for the start of the season. Several new men started the game and for the most part handled themselves very well. Dragowicz at second, who incidentally was Crane's captain last year, played a good game against his former teammates. Abe Gent handled the third base without an error and followed with some good work at the bat. Aste, another new man, took the center field job with fair success. We understand that he is a good pitcher which is not bad news. In the eighth inning Simpson, a real find in the freshman class, went to the mound and did a few movements for the boys. The result was some more strikeouts and no runs for Crane. Also in the eighth, Hall replaced Edstrand, and Reichle went in for Neustrom.

## INTERFRATERNITY ATHLETICS

Due to very cold weather, the interfraternity track meet had to be postponed and at a later meeting it was decided to hold the meet over until next year. There were few dates available and these did not meet with the approval of the council. The cup, now in the possession of the Phi Pi Phi fraternity who have won a leg on it, will remain in their keeping until next year.

A schedule has been arranged for an elimination tournament in both tennis and baseball. The baseball this year is to be played with indoor rules. It was thought by the council that such a game would meet with more favor among the different fraternities. The tennis rules will be the same this year as last, that is, two single matches and one double with at least three men playing. The games are to be played at the rate of one per week, the baseball games starting April 11, and the tennis matches starting the week of May 2. The order of the combats is as follows:

### BASEBALL

Triangle vs. Phi Kappa Sigma
Phi Pi Phi vs. Bye
Sigma Kappa Delta vs. Bye
Delta Tau Delta vs. Bye
Beta Psi vs. Rho Delta Rho
Theta Xi vs. Bye
Sigma Alpha Mu vs. Bye
Kappa Delta Tau vs. Bye

### TENNIS

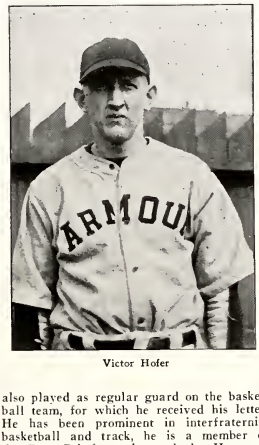
Rho Delta Rho vs. Sigma Alpha Mu
Phi Kappa Sigma vs. Bye
Kappa Delta Tau vs. Bye
Phi Pi Phi vs. Bye
Theta Xi vs. Beta Psi
Sigma Kappa Delta vs. Bye
Triangle vs. Bye
Delta Tau Delta vs. Bye

## OUR VARSITY CAPTAINS

### BASEBALL

### Victor Hofer

Vic Hofer, the *Battling Architect*, is this year's leader of the Tech ball team. Vic is playing his fourth year of varsity ball. He has played a good game all the time at Armour and always batted as cleanup man. For the last three years, he has led the team with his batting average. Vic has




Victor Hofer

also played as regular guard on the basketball team, for which he received his letter. He has been prominent in interfraternity basketball and track, he is a member of the Beta Psi fraternity and the Honor A society, and has done a great deal of work on the art staff of the *Cycle* in the last two years.

Hofer came to Armour from Lane High School where he played with the baseball, football, and track teams. While there, he played as an outfielder on the team that won the city championship. In his first year here he played at first base and the next year alternated between first and catcher. Last year Vic caught and will most likely fill this position again this year.

Hofer will graduate with his class at the end of the present season and Tech will lose a fine baseball player and a loyal student.

## BOXING

The boxing team went to Culver for a meet in April, but was defeated. Garbett was the only man on the team to obtain a decision over his opponent in the six bouts. Cohen, the battling heavyweight, had his nose broken again. The rest of the team were subjected to a more or less severe pounding.

## TENNIS

The tennis team has a hard schedule ahead of them. Manager Macy has worked hard on the pen and the result may be seen below. There are several letter men back in school this year with Captain Jennings and work is going along nicely. It will be remembered that the team did not lose a match last year. They are out to repeat if possible this year but they do desire a little support from the rest of the school.

April 23, Armour vs. North Central at Naperville, Illinois.
April 29, Armour vs. Loyola at Loyola Courts.
April 30, Armour vs. Lake Forest at Armour Courts.
May 5, Armour vs. Wheaton at Armour Courts.
May 7, Armour vs. Marquette at Armour Courts.
May 13, Armour vs. Michigan State at East Lansing, Michigan.
May 17, Armour vs. Hillsdale College at Armour Courts.
May 19, Armour vs. Marquette at Milwaukee, Wisconsin.
May 20, Armour vs. Lake Forest at Lake Forest, Illinois.
May 21, Armour vs. North Central at Armour Courts.
May 26, Armour vs. Michigan State at Armour Courts.
May 27, Armour vs. Wheaton at Wheaton, Illinois.

## GOLF

The golf team has been doing the course a few times. The loss of Wes Miller has been keenly felt but the remaining men on the team under the leadership of Captain Urban are working hard. Coach Leigh has several veterans back in Peterson, Bates, and Lang. Christianson and Quinby are also out for the team. In addition to the schedule announced in the last issue, the team will travel to the Intercollegiate Conference meet, June 13-15, at Marquette University, Milwaukee.

The golf team, like the tennis team, has turned in a very good record for the past few years. In fact, they put some of the major sports to shame by their fine records. The home games are played at Ninety-first and Western for the information of those desiring to view the team in action.

## BLANKETS TO BE AWARDED

As previously announced, the students voted to award the athletes blankets. This plan has been carried through and some forty men who have graduated since the Armour Tech Athletic Association was formed in 1923, and who won their major letter at Armour will receive the blankets this spring, possibly Circus Day. The blankets are black with a large yellow "A" in the center. Among the forty men, there are about six men who will graduate this year. They will receive their blankets after graduation.

## FRATERNITIES

(Continued from page 144)

to wish all students and members of the faculty, a most pleasant vacation. To Dean Monin, especially, do we extend our sincere farewell — a gentleman, a scholar, and a real man.

## SPHINX

This spring, the Sphinx pledge group was the largest in the history of the organization. Initiation took place on the night of May 18, at the Brevoort Hotel. It ended a long, and in some cases, strenuous pledge period for the men. We take pleasure in announcing that the following are new members of Sphinx:

W. D. Allen
W. A. Anderson
R. E. Brumund
J. Grosguth
E. B. Kapke
J. W. Kent
G. Kleinert
H. Kohn
C. Long
K. H. Parker
M. B. Tracy
A. Tully
C. VanderMolen

## PHI KAPPA SIGMA

With the spring months come baseball, track, tennis, Junior Week, Circus Day, and other social activities at Armour. Social functions at Alpha Epsilon also increase with the approach of balmy weather.

The last of April saw two outstanding events, the semi-annual alumni smoker at the house and also the annual faculty banquet. The latter is always looked forward to by the chapter, as it gives them a chance to meet the professors on a social basis.

As a last social get-together, the chapter gives a party for its graduating seniors during the last of May. This acts as a farewell to them as well as a fitting close to the social season. We wish to extend our best wishes to those who are leaving us this June.

## THETA XI

As we pause at this point in the school year and look back at the activities of the past semester, it seems that a very large proportion of them were social events. However, the Calculus book, the Physics Laboratory, and other unpleasant memories loom too close and too large on the horizon to permit us to utterly forget them. In retrospect, however, it is much more pleasant to think of the lighter social affairs, remembering that even these form a large part of extra-curricula education.

The Hard Times party started off the second semester and furnished pep for several weeks. Minor events then tided over the gap until March 20, when the following three men took the path of trials and followed it through to the bitter end. We are proud indeed to announce the initiation of:

P. E. Heath
W. K. Simpson
D. T. Smith

The Sunday following Easter was designated as Parents' Day. On this day the house was thrown open and our entertainment offered to the mothers and fathers, both real and adopted, who could arrange to be present.

On April 30, the sixty-third anniversary of the fraternity was honored by a semi-convention crowd at the chapter house. It is occasions such as these that bring brothers in far parts of the country together in spirit.

## SIGMA KAPPA DELTA

Within the next few weeks will come the close of another profitable year for Sigma Kappa Delta. We will lose some very fine fellows by graduation, but the rest will try to carry on.

Since the last issue of The Engineer, we enjoyed one of the best times we have ever had at a house dance. The affair was a hard times party and the house was all but torn down to arrange a proper setting. We admit that most of the fellows enjoyed themselves, and were quite worn out as a result. Another one of our fine house parties was enjoyed on the evening of May 7, and quite a turnout of both members and alumni resulted.

Indoor baseball is now coming to the front as the inter-fraternity athletic sport and Sigma Kappa Delta made a fine showing. Brother Alexander also has shown some good playing on the varsity nine. He has pitched well in all of his chances.

At this time we wish to announce that the following men have been pledged this semester:

E. Eisler
J. H. Tschudy

To Dean Monin, who has recently left the Institute, we wish much happiness. We are sorry to see him go, as he has been a friend to everybody, and will be greatly missed.

And now that the year is drawing to a

(Continued on page 148)

## ANSWERS TO "ASK ME ANOTHER' QUESTIONS

1. (a) Ascanio Sobrero, an Italian, 1846;
   (b) Alfred B. Nobel, a Swedish chemist. His patent for dynamite was granted in 1867.
2. Blasting caps and electric blasting caps.
3. Nitroglycerin.
4. (a) Joseph A. Holmes.
   (b) Scott Turner.
5. Sulphur, charcoal, and Chile saltpeter.
6. Faster.
7. A galvanometer or an ohmmeter-galvanometer.
8. Block-holing, snakeholing, and mud-capping.
9. 17,500 feet a second.
10. December, 1679, at Ottawa, Ill., by Father Hennepin, a French explorer.
11. In parallel.
12. Gelatin.
13. Fulminate of mercury.
14. Twenty-five pounds.
15. (1) That the explosive is in all respects similar to the sample submitted by the manufacturer for test.
    (2) That detonators, preferably electric detonators, are used of not less efficiency than those prescribed, namely, not weaker than a No. 6 detonator.
    (3) That the explosive, if frozen, shall be thoroughly thawed in a safe and suitable manner before use.
    (4) That the quantity used for a shot does not exceed 1½ pounds (680 grams) and that it is properly tamped with clay or other non-combustible stemming.
16. Ammonia dynamite, gelatin dynamite, straight nitroglycerin dynamite.
17. The Explosives Engineer.
18. FFFF, FFF, FF, F, C, CC, CCC.
19. (a) James F. Callbreath.
    (b) H. Foster Bain.
    (c) Stephen S. Tuthill.
    (d) J. R. Boyd.
    (e) Gen. R. C. Marshall, Jr.
    (f) W. S. Hays.
20. The Moffat Tunnel, in Colorado, length, 6.19 miles.
21. Squarely across (Not on an angle).
22. Wood.
23. By burning.
24. Pennsylvania.
    Total consumption for 1926:
    Black Powder, 29,517,125 lbs.
    Dynamite, 47,918,261 lbs.
    Permissible Explosives, 33,565,470 lbs.
25. Dynamite. A free copy of a book entitled, "Dynamite—The New Aladdin's Lamp" can be obtained by writing to The Explosives Engineer, Wilmington, Delaware.

CHARLES W. HILLS CHARLES W. HILLS, Jr.

CHARLES W. HILLS

PATENT, TRADE MARK, COPYRIGHT
AND UNFAIR COMPETITION LAW

1523-38 Monadnock Building
CHICAGO

*Cable Address Hillsford, Chicago* *Telephone, Harrison 6150*

# ENGINEERING NEWS

## THE WORLD'S LARGEST BLAST FURNACE

### Weirton Stack Embodies Latest Blast Furnace Design

A blast furnace is a piece of chemical apparatus designed to hold the products of a very vigorous chemical reaction, namely, the liberation of iron resulting from the reduction of iron ore by carbon in the form of coke. As a piece of chemical equipment the blast furnace ranks as the largest known, both from the standpoint of capacity and from that of materials going into its construction. Another factor that adds to the cost and complexity of the installation is that a stack of itself is of no value—there are a number of pieces of auxiliary equipment which, when properly used in conjunction with the stack, form a unit technically known as a *blast furnace*. The correct use of the term blast furnace thus includes all the auxiliary equipment, while the actual furnace in which the reduction of the iron ore takes place is called the *stack*. Among the auxiliary apparatus necessary in a complete blast furnace can be mentioned the cast house, where the casting takes place; hot blast stoves, for preheating the air blast; hot metal and slag handling equipment, such as ladle and cinder cars; and stocking and charging apparatus, including such items as an ore bridge, car dumper, ore yard, coke breeze equipment, scale car, stock bins, hoist engine, and bell operating rigs. Then there are boiler and power house installations necessary to furnish the energy for pumping the enormous volume of cooling water and for operating the auxiliary apparatus. All of which goes to show that a blast furnace unit is a mighty complicated and expensive proposition.

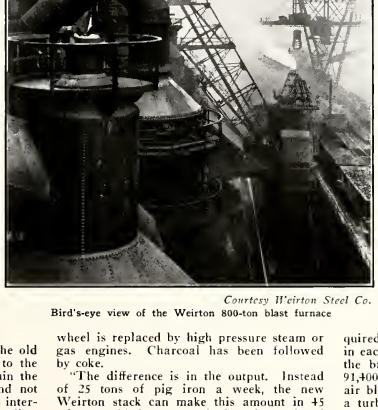
A few years ago a blast furnace with a rated capacity of 500 or 600 tons of iron in 24 hours was considered a large stack; in November, 1926, the Weirton Steel Company put into operation an 800 ton furnace at their Weirton, W. Va., works. Completion of this unit, which is the largest in the world, is only a part of an $18,000,000 improvement program recently undertaken by this progressive company.

As an interesting contrast between the old and the new, F. A. Hanlin, assistant to the president, gives the following: "Within the limits of Hancock county, W. Va., and not over 4 miles apart, are to be found two interesting structures which represent the earliest and the latest types of iron blast furnaces in the United States. One is the old furnace built between 1790 and 1800 on the banks of King's Creek, a grand old relic with just enough stonework standing to show the original outline and size of the furnace.

"From this furnace can be seen at night the glare of this modern 800 ton blast furnace built a century and a quarter later.

"The old King's Creek furnace, like others of its time, was located near the foot of the hills which furnished the iron ore, limestone, and forests for the charcoal fuel. A stream nearby turned a wooden wheel that furnished power to blow the air into the furnace, producing the necessary draft.

"Since the erection of this furnace many changes have come about; the blast furnace has developed hand in hand with the increased use of mechanical and electrical power and the manufacture of suitable construction materials. But the world's largest furnace cannot do anything metallurgically that the old King's Creek furnace could not do. The old ox teams have given way to railroads, the baskets used for charging the furnace are supplanted by powerful electrically-driven machinery, and the water wheel is replaced by high pressure steam or gas engines. Charcoal has been followed by coke.



*Courtesy Weirton Steel Co.*

Bird's-eye view of the Weirton 800-ton blast furnace

"The difference is in the output. Instead of 25 tons of pig iron a week, the new Weirton stack can make this amount in 45 minutes. Today more pig iron is produced in one month in the new furnace than could have been made in the old King's Creek furnace in continuous operation in a period of 18 years."

The expansion program at the outset included new river docks, an additional battery of 49 Becker type by-product coke ovens, four 250 ton open-hearth furnaces, a new hot and cold-rolled stripsheet department and a pipe mill in addition to the 800 ton blast furnace already mentioned. To take care of the new furnace, the ore storage yard was extended and a 10 ton ore bridge installed. The bridge has a span of 281.5 feet and a runway 900 feet long. The bridge has an overall length of 339 feet. Approximately 400 tons of fuel is being handled an hour. To prepare for the new unloading dock it was necessary to dredge from the bottom of the Ohio river over the entire area from the solid rock, a harbor 1500 feet long, 110 feet wide and 14 feet below full pool elevation. The reinforced concrete unloading dock is 400 feet long.

The stack itself is 92 feet high and rests on concrete foundations 20 feet above yard level to the center of the iron notch. The hearth is 21.5 feet in diameter and the bosh, 24 feet in diameter. Approximately 660,000 bricks were used to line the stack, which has a content of 43,000 cubic feet. The stack proper is supported by 12 cast-iron columns and is blown with 12 tuyeres. Eight rows of copper cooling plates were inserted above the mantle for cooling the inwall lining.

The charge is dropped into the furnace by the double bell system. Both bells are air operated. The large bell is 13 feet in diameter and the small bell 5.5 feet in diameter. Gas is led out of the furnace through four uptakes 90 degrees apart. Downcomer pipes connect with the uptakes near the top and each two combine into a single pipe which leads to the primary dust-catcher. The dust-catcher, 24x40 feet, is of the centrifugal type. The secondary cleaner is a Freyn-type whirler.

Following this stage of cleaning, part of the gas is led through a main to the boiler house where it is used for steam generation, while the remaining gas is passed into a washer. The gas issuing from this washer carries a little dust, but it is passed into a drier where considerable moisture and entrained water is extracted. The dust entrapped in both the dust-catcher and whirler is converted into sinter for recharging into the furnace.

The blast is heated in four stoves, 25 feet in diameter and 100 feet high. The lining for each stove required 524,900 bricks. The checker openings in each stove are 4.5 inches square and, with the brick in the combustion chamber, offer 91,400 square feet of heating surface. The air blast itself is supplied to the furnace by a turbo blower, 70,000 cubic feet a minute being supplied at 20 pounds pressure, or 60,000 cubic feet per minute at 30 pounds pressure.

To take care of the increased demand for service water for the new furnace and the additional open-hearths, three 10,000 gallon pumps were installed. The continuous Cochrane hot process water softening plant is the largest ever built, and a capacity of 160,000 gallons per hour is needed to supply the water for the boilers. Exhaust steam from the air-rejectors, auxiliary pumps, etc., furnishes the steam for preheating the water.

Additional generating capacity has been provided for by the addition to the existing

(*Continued on page 150*)

# HUMOR

## *A Hearty Laugh Doeth Good Like a Medicine*

### Another Variation

Wife: Didn't I hear the clock strike two as you came in last night?

Other Half: You did. It started to strike eleven and I stopped it so's not to awaken you.

*—Green Gander.*

---

First Burglar—"Where 'va been?"
Second Burglar—"In a fraternity house."
First Burglar—"Lose anything?"

*Michigan Technic.*

---

Best Man: Wasn't it annoying the way that baby cried all during the ceremony?

Maid of Honor: It was dreadful. When I am married I shall have engraved on the invitations, "No babies expected."

*Jack-o'-Lantern.*

---

Teacher: "Now, Danny, what are you doing, learning something?"

Danny: "No, Ma'am, I was just listenin' to you."

---

### Such a Dig

Dizzy Davis: I had a date with a professional mind-reader last night.

Duffy: How did she enjoy her vacation?

*—Arrow.*

---

"What would happen if this elevator should drop to the bottom?" asked a timid passenger as the car sped by the forty-second floor.

"Gosh!" exclaimed the operator, turning pale at the very idea; "I'd lose my job!"

---

### A Prodigy

A gentleman living just outside of Chicago went into the city to his office each day. When he was leaving home on the morning before Christmas, his wife said she would like him to bring a banner for her Sunday-school class to use at an entertainment that evening, but that she did not yet know the wording and size needed. They agreed that she should send him a telegram during the day, giving him these two items. Consequently, before starting for home in the afternoon, he went to the near-by telegraph office and found quite an excitement over the message which had just been received and which read: "Unto us a child is born. Three feet wide and six feet long."

---

Joe Hunter: "Do you think I will ever be able to do anything with my voice?"

Professor Childs: "Well, it might come in handy in case of fire or shipwreck."

---

### An Idea

Inspired Soph (to Doc Sousley): "Say, Doc. do catenarys have kittenoids?"

---

The expounder of legal wisdom was almost speechless as he gazed upon the scene of the Grand Canyon.

"Isn't it superb, wonderful, inspiring?" he asked his companion, a consulting engineer.

"Yep," responded the C. E. dryly, "that was some excavating job."

### The Freshman

The boy danced 'round as though on air,
His head was in a whirl.
His eyes and mouth were full of hair,
His arms were full of girl.

He told the maiden of his love,
The color left her cheeks
But on the shoulder of his coat
It showed for weeks and weeks.

*—Rutgers Targum.*

---

It's great to be an editor
To sit up late at night,
And scratch your wool
And throw the bull
And write and write and write.

---

Estelle—"Ralph says he wouldn't marry the nicest girl living."

Doris—"What a cheek! As if I'd have him!"

---

Soph—Did you ever take chloroform?
Frosh—No. Who teaches it?

---

Teacher: "My lad, do you know what becomes of little boys that use bad language when they break their toys?"

Little Boy: "Yes, sir; they grow up and study engineering."

*—Kansas State Engineer.*

---

Ruth: I wish I were a big strong man like you.

Leonard: Why?

Ruth: So I could show a girl like me how strong I was.

*—Michigan Technic.*

---

Guest: "Waiter, there is a fly in my ice cream!"

Waiter: "Let him freeze and teach him a lesson. The little rascal was in the soup last night."

*—Puppet.*

---

Tommy, isn't it rather extravagant to eat both butter and jam on your bread at the same time?

Oh, no, mother. It's economy. You see the same piece of bread does for both.

---

Inquisitive Old Lady—Do boats like this sink often?

Gob—Only once.

---

### As Chaucer Would Put It

"Spring is inne, coming inne,
An egge hath my hamme,
Passeth bus, and splasheth us,
Loud singe,—gosh darn it!"

---

Sailor: The Captain? Oh, he's over on the sartboard side, sitting on a hatch.

Sweet Young Thing: Gracious! Why don't you keep a hen?

*—Altar Fixit.*

---

Helen—Oh, George, think of coming to ask papa's consent in such shabby clothes.

Vye—That's all right. I had one suit ruined.

---

Soph—"Did you take a bath?"
Frosh—"No—is there one missing?"

### A Choice of Terms

A track supervisor received the following note from one of his track foremen:

"I'm sending in the accident report on Casey's foot when he struck it with the spike maul. Now under 'Remarks', do you want mine or do you want Casey's."

*—Wisconsin Engineer.*

---

"Say, Bob, can I borrow your pen?"

"Sure thing."

"Got a sheet of writing paper I can use?"

"Reckon so."

"Going past the mail box when you go out?"

"Uh-huh."

"Wait a minute till I finish this letter, will you?"

"All right."

"Want to lend me a stamp?"

"Yeh."

"Much obliged; say, what's your girl's address?"

*—Minnesota Techno-Log.*

---

### —Or a Flywheel

Prof, after explaining measurement of horsepower of various engines: "Are there any questions?"

Bright Civil: "How would you measure the horsepower of a donkey engine?"

*—Wisconsin Engineer.*

---

Young Knut—"I say, waitah, nevah bring me a steak like that again."

Waiter—"Why not, sir?"

Young Knut—"It simply isn't done, old thing!"

---

The Scotchman who offered a prize to the first person to swim the Atlantic has recently announced that the winner must swim the distance under water.

---

"I guess I've lost another pupil," said the professor as his glass eye rolled down the kitchen sink.

---

"My girl's father threw another party last night."

"Was it for you?"

"No, it was me."

---

Inquiring Customer—Why do you advertise that your coal burns like a movie queen's love?

Clerk—Because it's been screened, lady.

---

### Our Question Box

Q—Please tell me why a girl always closes her eyes when a fellow kisses her.

A—If you will send us your photograph we may be able to tell you the reason.

---

"Dr. Goofus certainly has worked himself up, hasn't he?"

"How is that?"

"He used to be a chiropodist; now he's a dentist."

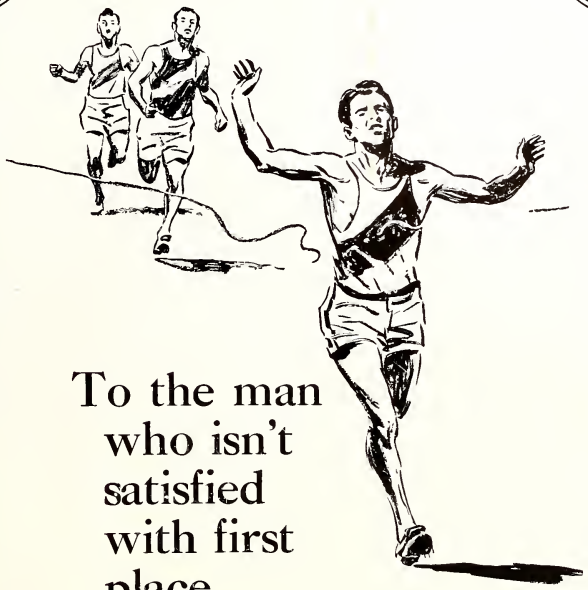
---

"Where are you running?"

"To stop a fight."

"Who's fighting?"

"Oh, just me and another freshman."



# To the man who isn't satisfied with first place

THE man who wins a race can't afford to get complacent over it. His next step is to improve on his own running time.

The electrical communication industry in America ranks first in the world, with exceptional facilities for research and constructive work.

But the men in this industry are never satisfied to let it go at that. No process, no matter how satisfactory, by whom devised or how well bulwarked by age, is here immune from challenge.

This dynamic state of mind must appeal mightily to men who are pioneers at heart.

*Published for the Communication Industry by*

**Western Electric Company**

**Makers of the Nation's Telephones**

*Number 68 of a Series*

## ENGINEERING NEWS

(Continued from page 147)

power station of a 7500 kw. generator with a Wheeler-type surface condenser. A substation was built to furnish direct current for the operation of the ore bridge and for other plant purposes.

The picture on the cover, drawn from a photograph, shows the unit as it appears at present. The single concrete chimney shown removes the combustion products of the stoves, and is 8 feet in diameter at the top and 225 high. This will give some idea of the huge size of the unit. The furnace is of 800 tons normal capacity, but is expected to reach much higher rating, as operation at the end of the first 30-day period has shown a daily tonnage above its normal capacity.

The furnace was blown in November 20, 1926. One of the remarkable features of the unit is the exceptional time that was made in its construction, for work on the new layout was not commenced in the engineering department until January 1st of that year. Five hundred twenty-five days for a job of this magnitude is a remarkable tribute to the efficiency and effectiveness of modern engineering.

## FRATERNITIES

(Continued from page 146)

close and the students will soon be disbanding, Sigma Kappa Delta wishes all a pleasant summer vacation.

### PHI PI PHI

With the coming of spring, great activity may be seen in the vacant lot across the street from the chapter house; ball playing, horseshoes, or what have you. At noon our playground is the scene of a spirited indoor game.

We wish to announce the pledging of the following men, to Gamma of Phi Pi Phi:

G. A. Rezac
Garland Richley
Thomas Sullivan

The feature party of the year, our annual Easter Tea, was held at the house Sunday, April 17. The display of new Easter toggery, added the finishing touches of a great success to the wonderful affair. A large number of our alumni were present and were unanimous in an expression of a desire to come again.

With the closing of another school year, Gamma of Phi Pi Phi wishes to extend the best of wishes for a happy summer to her friends.

### TRIANGLE

The convention of Triangle, is to be held at the Edgewater Beach Hotel. Armour Chapter is again the host and many things are planned. *Sunny* will be absorbed by all, a whole section of the theater being turned over to Triangle.

With the closing of this school year, Triangle entertains nothing but optimistic views of the future.

### BETA PSI

The social activities of the chapter have been limited to one party since the beginning of the semester. In March, a joint meeting of the alumni and chapter members was held at the house. On this occasion Professor Griffith was initiated into the fraternity. On April 16, the alumni chapter of Chicago held a dance and card party at the house, to which the graduating seniors were invited. This will be an annual occurrence.

The following men have been pledged to Beta Psi:

P. R. Anderson
F. Austin
A. C. Gunther
E. F. Hanke
K. Langhammar
H. Virgo

### KAPPA DELTA TAU

Kappa Delta Tau wishes to announce the initiation of the following men:

M. Broude
J. E. Ellman
T. Friedman
S. P. Garfinkle
W. Olefsky
H. Stein

The most important event on the Fraternity calendar for this semester was, of course, the initiation, held Saturday, March 5. The ceremonies were held deep in the Indiana Dunes at the summer cottage of Lois Needleman, one of our alumni. Here, on a night fit for murder—and initiations, the pledges became members of Kappa Delta Tau at the most impressive initiation the Fraternity has ever known.

Kappa Delta Tau is proud to announce the pledging of George Hellar.

In closing, the active chapter wishes the greatest success to the students in their various occupations during the summer.

MAGIE BROTHERS
MANUFACTURERS OF
LUBRICATING OILS
AUTOMOBILE OILS
CUTTING COMPOUNDS
GREASE, COTTON WASTE
AND BOILER COMPOUND
2135-37 So. Loomis Street, Chicago
Telephones: Canal 7125-7126

LALLY COLUMNS
are
Steel-Shell,
Concrete-Filled
Building Columns
with
Steel Caps and Bases
Dependable
—Economical
Have Given Satisfaction
for 29 Years
Prompt Shipment
LALLY COLUMN CO.,
OF CHICAGO
4001 Wentworth Ave.,
CHICAGO, ILL.
Boulevard 5871-72

# Refrigeration Engineers Prefer *Armour's* *Anhydrous Ammonia*

ARMOUR'S Anhydrous Ammonia is made from aqua-ammonia, a by-product of the coking industry, and is guaranteed to be absolutely pure, dry and volatile—absolutely free from foreign substances. It is economical because its purity assures the removal of all possible heat units at a minimum operating expense. Every cylinder is tested before shipment, and is shipped subject to your evaporation test before using.

For these reasons, leading authorities have held Armour's Anhydrous Ammonia to be the most efficient as well as the most practical medium for refrigeration purposes.

Skill, long experience and superior equipment combine to give it a quality that is not excelled. Fifty pound, one hundred, and one hundred and fifty pound cylinders are carried in stock at all principal shipping points.

*Write for Full Particulars*

ARMOUR AMMONIA WORKS

*Owned and Operated By*

**ARMOUR AND COMPANY**

CHICAGO

# Armour Institute of Technology
## Chicago

## The College of Engineering Offers Courses in

ELECTRICAL ENGINEERING
MECHANICAL ENGINEERING
CIVIL ENGINEERING
FIRE PROTECTION ENGINEERING
CHEMICAL ENGINEERING
ARCHITECTURE

*These courses are each four years in length and lead to the degree of Bachelor of Science*

COMPLETELY EQUIPPED SHOPS AND LABORATORIES

## *The* Institute Bulletins

Will be Sent on Application


## FIRE LOSSES

*(Continued from page 132)*

spalls but slowly under heat. Tile tends to crack and spall badly. There is wide variation, however, in the fire-resistance of the different kinds and types of tile.

The value of fire walls and enclosures is lost if openings through them are not properly protected. Door openings are usually protected in new buildings, but often openings for conveyors or chutes are disregarded. Satisfactory arrangements can be developed for practically any type of opening. In remodeling, doorways are often left unprotected. Abandoned pipe holes are frequently found.

With proper sprinkler protection, fires in industrial buildings are usually quickly extinguished. The water loss, however, may be considerable. Ordinary wooden floors leak badly. Concrete floors vary in water tightness.

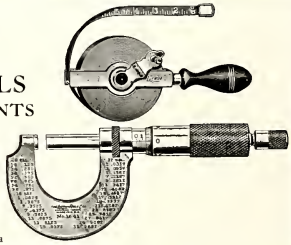
Often due to circumstances beyond his control, a factory owner finds that he is forced to considerable expense to protect his property from its surroundings. Adjoining property may contain hazardous processes or storage. It may be either poorly built, or poorly protected, or both. Sometimes the exposure is of a more general nature, such as a conflagration district of wooden tenements. In any case, two courses of action are usually possible. The exposure may be either removed or abated, or protection against it provided.

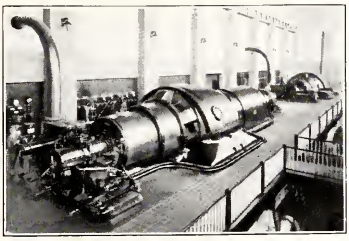
The best protection against adjoining exposure is a definite physical barrier, such as a blank brick fire wall. If windows are necessary, they can be protected by tin-clad shutters, wire glass, or open sprinklers, either alone or in combination. Tin-clad shutters give good protection for a limited time if closed. When assisted by wire glass, they make good protection against a conflagration. Fortunately there is usually time to close them in a fire if they are found open.

LUFKIN

TAPES, RULES, TOOLS
INSURE YOUR MEASUREMENTS
On Sale Everywhere
Send for Catalog

THE LUFKIN RULE CO.
Saginaw, Michigan
New York Windsor, Canada





Illinois Electric Power Co., Peoria, Ill. Two 20,000 K. W., 1,800 R. P. M. Steam Turbo-Generator Units installed in 1925.

## DEPENDABILITY

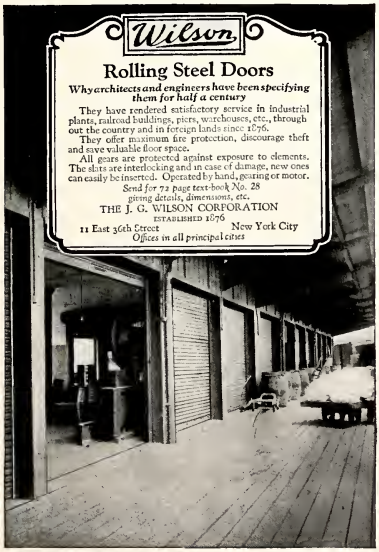
***Allis-Chalmers Steam Turbine Units***
***1926 Service Record***

| Unit No. 2 was available for service | Unit No. 1 was available for service |
|---|---|
| 97.7% of total elapsed time. | 97.0% of total elapsed time. |
| 1.7% spent on customary annual inspection. | 2.3% spent on customary annual inspection. |
| 0.6% outage due to other causes. | 0.7% outage due to other causes. |

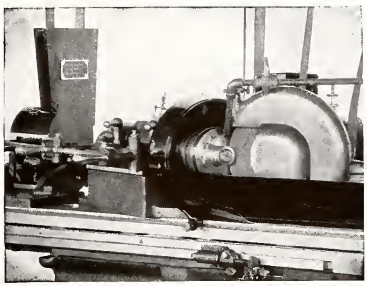
**Allis-Chalmers Turbines of Type and Size for any Service are Consistently Dependable.**

**ALLIS-CHALMERS MANUFACTURING CO.**
**MILWAUKEE, WIS. U.S.A.**







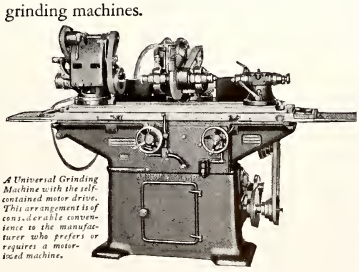



*And for Grinding Service — manufacturers come confidently to Brown & Sharpe*

A BROWN & SHARPE Universal Grinding Machine is shown above with a special set-up for grinding inner races for roller bearings. Production was speeded up by the arrangement and the result was a considerable reduction in the cost of grinding this piece.

The entire set-up was designed and built by the Brown & Sharpe Grinding Service Department. Years of experience in handling all kinds of grinding enable this department to provide the most efficient and economical solution of the problems that are continually being brought to them.

Manufacturers continue to use this service because it saves them time and money. We are always ready to furnish upon request, any information we have available regarding grinding and grinding machines.



*A Universal Grinding Machine with the self-contained motor drive. This arrangement is of considerable convenience to the manufacturer who prefers or requires a motorized machine.*

**BROWN & SHARPE MFG. CO.**
**PROVIDENCE, R. I., U. S. A.**

## BUSINESS AND THE ENGINEER

(Continued from page 134)

communities. Evidently, the results have justified the action taken at that time to establish a direct contact between the engineer and the community; and recently plans were announced for the financing of ten additional expert fire prevention engineers in order that the scope of this effective work might be enlarged.

The larger cities over the country are now realizing more fully than ever before the economic value of adequate prevention and protection measures, and the survey of the field engineer serves as the basis of the work of committees or organizations within the community who may be charged with the success of the campaign.

America's shameful per capita fire loss of approximately five dollars might well have been increased many fold had it not been for the foresight of certain men in that great industry of fire insurance who realized that they must not only tell the people, in an impressive way, what had happened in the past but, even more important, they must suggest remedial measures, based upon careful and thorough research of engineers in the laboratory and in the field. The public will challenge a statement that they are not doing things in the most sensible and effective manner, and the case must be proven.

Notwithstanding the tremendous bearing which this deplorable fire waste has upon the lives of all mankind, there is a pronounced disregard of the conditions to which a large part of it may be attributed. Many persons, well versed in the financial and industrial problems of the day, display incredulous ignorance in their superficial analysis of fire prevention engineering. In the larger centers of industry and finance this condition has been largely overcome but it is quite certain that in the more sparsely settled portions of the country, conclusive proof of the value of the engineer's work and analysis of specific conditions has not yet penetrated, due probably to the fact that the engineer has been deprived of that personal contact which is necessary to convince the individual, particularly when he is on his own ground. Obviously, it is not possible for ten expert fire prevention engineers to establish personal contact with the many individuals who would be directly benefited by their assistance. Rather must their work be along community lines, the individual contact depending upon those organizations which can reach the greatest number in the most effective manner. Here the extensive organization of the many fire insurance companies in the United States is of inestimable value. Many thousands of agents are scattered over the United States, and with the proper education of this vast army it is apparent that a very large proportion of those persons directly interested can be reached.

It is true that a relatively insignificant proportion of these agents are in a position personally to provide reliable engineering service, and it is quite natural, therefore, that they should turn to the fire insurance company they represent for suggestions and advice regarding specific cases requiring attention. The fire insurance company, it can be seen, must be in a position to furnish this information promptly and their recognition of this fact is demonstrated in their more extensive employment of engineering graduates in recent years. Most significant in this connection is the comprehensive plan inaugurated in 1920 toward the financing of twenty-five scholarships each year in the course of fire protection engineering at Armour Tech. It comprises a very definite expression from a leading organization of fire underwriters as to their confidence in the ability of the engineer to analyze conditions and to devise means of combating the fire waste.

**WIRE** automobile and airplane wires, electrical wires, submarine cables, bridge-building cables, wire rope, telegraph and telephone wire, radio wire, round wire, flat wire, star-shaped and all different kinds of shapes of wire, sheet wire, piano wire, pipe organ wire, wire hoops, barbed wire, woven wire fences, wire gates, wire fence posts, trolley wire and rail bonds, poultry netting, wire springs, concrete reinforcing wire mesh, nails, staples, tacks, spikes, bale ties, steel wire strips, wire-rope aerial tramways. Illustrated story of how steel and wire is made, also illustrated books describing uses of all the above wires sent free.

**AMERICAN STEEL & WIRE COMPANY**

*Sales Offices*

Chicago New York Boston Cleveland Worcester Philadelphia Pittsburgh Buffalo Detroit Cincinnati Baltimore Wilkes-Barre St. Louis Kansas City St. Paul Oklahoma City Birmingham Memphis Dallas Atlanta Denver Salt Lake City

Export Representative: U. S. Steel Products Co., New York

Pacific Coast Representative: U. S. Steel Products Company, San Francisco, Los Angeles, Portland, Seattle

KEYSTONE COPPER STEEL

## Steel Sheets that Resist Rust!

The destructive enemy of sheet metal is *rust.* It is successfully combated by the use of protective coatings, or by scientific alloying to resist corrosion. Well made steel alloyed with Copper gives maximum endurance. Insist upon

# KEYSTONE
## Rust-Resisting Copper Steel
# Sheets

*Black and Galvanized*

Keystone Copper Steel gives superior service for roofing, siding, gutters, spouting, culverts, flumes, tanks, and all uses to which sheet metal is adapted—above or below the ground. Our booklet *Facts* tells you why. We manufacture American Bessemer, American Open Hearth, and Keystone Copper Steel Sheets and Tin Plates.

**Black Sheets for all purposes**
**Keystone Copper Steel Sheets**
**Apollo Best Bloom Galvanized Sheets**
**Apollo-Keystone Galvanized Sheets**
**Culvert, Flume, and Tank Stock**
**Corrugated Sheets**
**Formed Roofing and Siding Products**
**Automobile Sheets—all grades**
**Electrical Sheets, Special Sheets**
**Deep Drawing and Stamping Stock**
**Tin and Terne Plates, Black Plate, Etc.**

Our Sheet and Tin Mill Products represent the highest standards of quality, and are particularly suited to the requirements of the mining, engineering, and general construction fields. Sold by leading metal merchants. Write nearest District Office.

American Sheet and Tin Plate Company
General Offices: Frick Building, Pittsburgh, Pa.

DISTRICT SALES OFFICES
Chicago Cincinnati Denver Detroit New Orleans New York
Philadelphia Pittsburgh St. Louis
Pacific Coast Representatives: UNITED STATES STEEL PRODUCTS CO., San Francisco
Los Angeles Portland Seattle
Export Representatives: UNITED STATES STEEL PRODUCTS CO., New York City

## Where dependability is vital

IN connection with a new pumping station at Milwaukee, Wisconsin, additional feeder mains were required. It was necessary that one of these should carry an unusually large proportion of the water supply, and 54-inch pipe was decided upon. Although pipe of material other than cast iron had a lower first cost, Cast Iron Pipe was chosen because the possibility of interruption to service had to be reduced to a minimum.

The photograph above shows a section of pipe being lowered into the ditch in the process of laying it.

THE CAST IRON PIPE PUBLICITY BUREAU
Peoples Gas Bldg., Chicago

# CAST IRON PIPE

*Our new booklet, "Planning a Waterworks System," which covers the problem of water for the small town, will be sent on request*

THE BELL & SPIGOT JOINT
THE ACCEPTED STANDARD FOR UNDERGROUND CONSTRUCTION

*Send for booklet, "Cast Iron Pipe for Industrial Service," showing interesting installations to meet special problems*

# HOW MANY OF THESE QUESTIONS CAN YOU ANSWER CORRECTLY?

THE following questions pertaining to explosives or to industries in which explosives are used should afford some pleasure and instruction for those who follow the popular indoor sport of "Ask Me Another".

The answers* to these questions are published in the May, 1927 issue of The Explosives Engineer magazine.

Write us today for a free sample copy of The Explosives Engineer, and when it arrives see how many of your answers check with the ones given by the Editors.

## QUESTIONS

1. (a) Who discovered nitroglycerin.
   (b) Who invented nitroglycerin dynamite?
2. What blasting supplies should never be transported or stored with explosives?
3. What high explosive is a liquid?
4. (a) Who was the first director of the United States Bureau of Mines?
   (b) Who is the present director?
5. What are the three ingredients of blasting powder?
6. Does safety fuse burn slower, at the normal rate, or faster when tightly tamped in a bore hole?
7. What electrical instrument is used for testing electric blasting caps and blasting circuits?
8. Name two of the three methods of blasting boulders. Name first the method that requires the least amount of explosive and the one which requires the most explosive, last.
9. What is the velocity of detonation of Cordeau-Bickford?
10. When, where and by whom was coal discovered in America?
11. What is the best connection for electric blasting caps when fired by a power circuit when ample current and voltage are available?
12. What type of explosive is the most water-resistant?
13. What is generally considered the best explosive ingredient for use in detonators?
14. How many pounds of black blasting powder in a standard keg?
15. Give the four conditions prescribed by the United States Bureau of Mines requisite for a Permissible explosive.
16. Name three types of high explosives commonly used for industrial purposes.
17. What magazine publishes a monthly digest of articles relating to drilling or blasting that have appeared in the technical press of the world?
18. What are the standard granulations in which black blasting powder can be obtained?
19. Name the secretaries of the following associations:
    (a) American Mining Congress.
    (b) American Institute of Mining and Metallurgical Engineers.
    (c) American Zinc Institute.
    (d) National Crushed Stone Association.
    (e) Associated General Contractors.
    (f) National Slate Association.
20. What great railroad tunnel has recently been holed through?
21. How should safety fuse be cut for insertion in a blasting cap?
22. Of what material should a tamping stick be made?
23. How should empty dynamite cases be disposed of?
24. What state consumes more explosives than any other state in the United States?
25. What explosive is referred to as "The New Aladdin's Lamp"?

THE EXPLOSIVES ENGINEER

941 KING STREET, WILMINGTON, DELAWARE

*Through the courtesy of *The Armour Engineer* the answers are also printed on page 146 of this magazine.

MISSISSIPPI - WIRE - GLASS - CO.
FIRE RETARDANT WIRE GLASS

# *Great buildings all over the nation have Mississippi protection*

because great architects recognize the superiority of Mississippi Wire Glass as to quality and appearance.

For fire protection and clear vision use the Standard Polished Wire Glass.

*Specify*

**"MISSISSIPPI"**

*The Recognized Standard in Wire Glass*

MISSISSIPPI WIRE GLASS COMPANY
220 FIFTH AVENUE, NEW YORK
*Chicago* *St. Louis*

Tribune Tower
*Chicago, Ill.*

Pennsylvania Terminal
*New York City*

Grand Central Terminal
*New York City*

Barclay-Vesey Building
*New York City*

Farmers' & Mechanics' National Bank
*Fort Worth, Texas*

Straus Building
*Chicago, Ill.*

Woolworth Building
*New York City*

Railway Exchange Building
*St. Louis, Mo.*

Bankers' Trust Co. Building
*New York City*

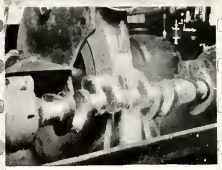
American Radiator Building
*New York City*

Graybar Building
*New York City*

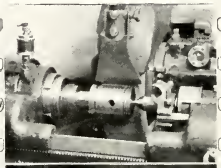
# "MISSISSIPPI WIRE GLASS"

NORTON COMPANY
WORCESTER, MASS.
*Presents*
"SPEED IN TRANSPORTATION"

Accuracy makes high speed possible. GRINDING makes possible accuracy -with rapid production- of the many vital parts of these great engines of commerce.



Among the hundreds of automotive parts being finished by GRINDING are: crankshafts, camshafts, pistons, piston pins, gears and rear-end housings.

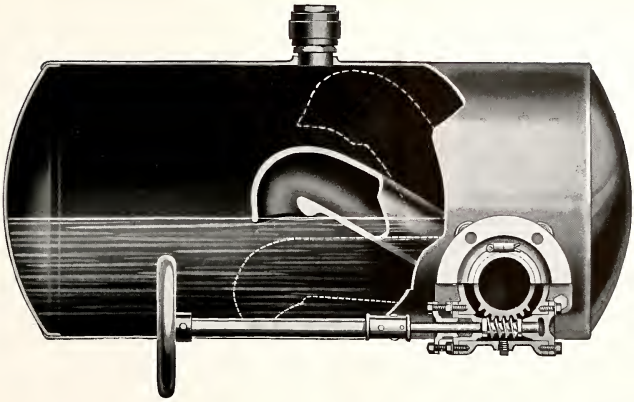


The great railroad systems, too, benefit from GRINDING-piston rods, pistons, link bars, air brake parts, manganese steel frogs and switches -and car wheels.

# NORTON

Grinding Wheels
Grinding Machines

Refractories-Floor
and Stair Tiles



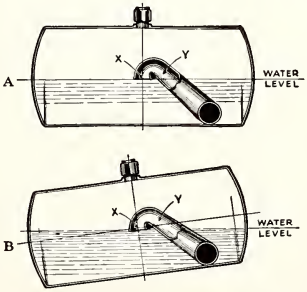
# —another reason why Koehring Pavers Produce Dominant Strength Concrete

VITALLY important to the resultant strength and durability of concrete is the admittance of an accurate amount of water into the mixing drum at exactly the right instant. Long ago the Koehring Company recognized this fundamental requirement and set to work to devise an automatic water measuring system.

Today, the system is as nearly exact and accurate as human ingenuity has been able to design. A balanced three-way valve is automatically opened at a certain point, by the charging skip as it is raised, admitting the water into the mixing drum at exactly the right instant. The regulating hand wheel governs to a minute accuracy the amount of water which is to be used per batch.

All dribble is eliminated by the syphon-gravity principle which draws the water through a straight 3½ inch pipe into the mixing drum. Straight flow from the tank to drum secures a fast, clean discharge.

This is another pioneering development by Koehring engineers which with the Koehring batch meter, Koehring boom and bucket, and Koehring five action remixing principle produces standardized, dominant strength concrete of unvarying uniformity.




A and B illustrate clearly why changes of grade do not materially affect the accuracy of water measuring when using the Koehring system. X represents the volumetric center of the tank and Y the measuring arm.

*"Concrete—Its Manufacture and Use" is a 210 page treatise on the uses of concrete, including 26 pages of tables of quantities of materials required in concrete paving work. To engineering students, faculty members and others interested we shall gladly send a copy on request.*

KOEHRING COMPANY
MILWAUKEE WISCONSIN

MANUFACTURERS OF PAVERS, MIXERS—GASOLINE SHOVELS, CRANES AND DRAGLINES

*Please mention The Armour Engineer*

# '27

Get work that you can respect, where they respect you.

Technical Industry welcomes the men from professional schools; believes in the value of their training; expects much of them, but no more than they must expect of themselves.

Some day you will come back—with every reason to be proud of yourself, we hope.

THE TIMKEN ROLLER BEARING CO., CANTON, OHIO

Sales engineering is broadening work, well rewarded. As an expert in your own line you come into intimate touch with the technical problems in many other lines. Applications are invited from men ambitious to employ their professional training in the industrial sales field.

*Please mention The Armour Engineer*

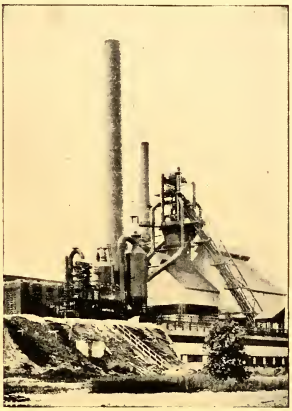
# *Devils for Rough Work—*
## *Yet Delicate in Design*

The steel industry demands and is using Otis Furnace and Bell Hoists for their modern blast furnaces. These may be in continuous operation night and day for periods of from three to seven years, depending upon business and life of furnace lining. Hence the Otis Hoist and Otis automatic controlling mechanism must be extremely reliable and constructed to withstand the severe strains and wear imposed by years of continuous service.

One of the most important features in connection with furnace hoists is the question of continuous operation. The machines must be entirely dependable, so that there will be no shutting down for repairs, as it is a very expensive matter to shut down a complete blast furnace, which would be necessary if the hoist were out of service.

The filling of the furnace itself is done by one man, all operations being so interlocked that the operators cannot deviate from the prescribed schedule. The furnace is filled by means of skips operated by Otis automatic electric hoisting machines. The materials used are ore, coke and limestone, each load of a kind being dumped into the skip from a car carrying material from the bins.

As the skip reaches the top of the furnace, it automatically delivers the material onto the upper valve or small bell of the furnace. As the skip starts down, an automatic device starts the small bell operating mechanism, allowing the small one to open and deposit the material on the lower valve or large bell. After a number of predetermined loads of the various materials have been deposited on the large bell, the automatic device starts this into motion, allowing the full load to slide off the bell into the furnace.

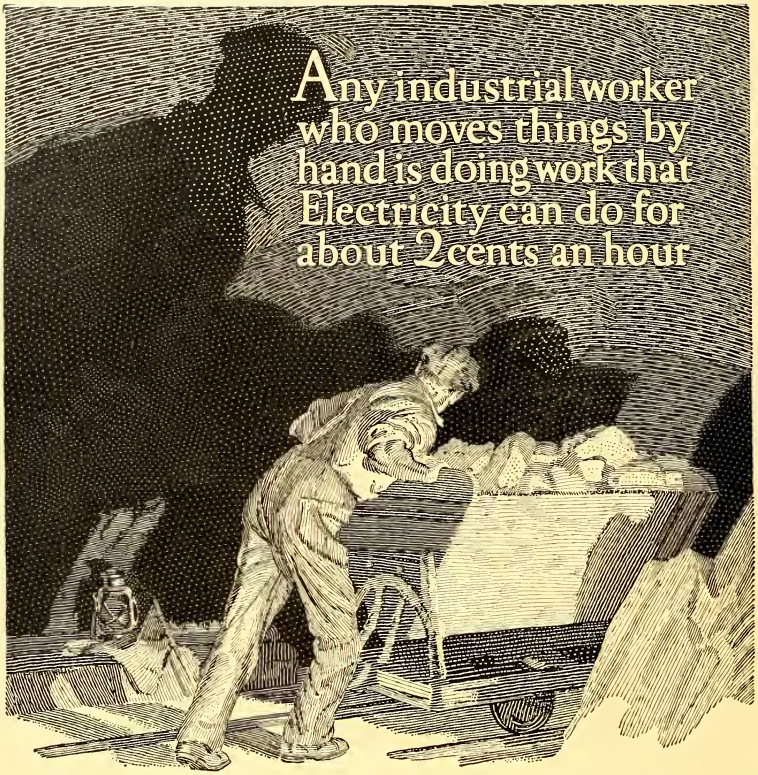


BLAST FURNACE WITH HOIST
Central Alloy Steel Corporation, Massillon, Ohio

THE WORLD'S WORD FOR ELEVATOR SAFETY
Otis

**OTIS ELEVATOR COMPANY**

Offices in All Principal Cities of the World




More than 60 per cent of the mechanical power used by American industry is applied through electric motors. But the electrification of the tasks performed by man power has hardly begun. Electric power not only saves dollars; it conserves human energy for better purposes and raises standards of living. College men and women may well consider how electricity can lessen the burdens of industry and of farm and home life.

You will find this monogram on all kinds of electric equipment. It is a symbol of quality and a mark of service.

201-66DH

# GENERAL ELECTRIC

GENERAL ELECTRIC COMPANY, SCHENECTADY, NEW YORK